

# **Social Competence at Age 4 Years, of Children Born Very Preterm**

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Kelly Marie Hood

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## **Dedication**

This dissertation is dedicated to my wonderful family. Mark, thank you for your enduring support and the many hours alone spent caring for our two young boys. Your efforts are much appreciated and will long be remembered. To our lovely sons, Matthew, who arrived following data collection and Nicholas, who arrived following the completion of the data analysis – thank you for your acceptance of the many occasions mummy had to work. xx

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## **Abstract**

Very preterm birth is an important developmental and public health concern, with clear evidence to suggest that very preterm children may be at long term risk of neurodevelopmental impairment and educational difficulties. Although a great deal is known about the neurodevelopmental outcomes associated with very preterm birth, comparatively little is known about the social competence of children born very preterm during the important early childhood period. Therefore, as part of a prospective, longitudinal study, this research examined the social competence of 105 children born very preterm (birth weight <1,500 g and/or gestational age  $\leq 33$  weeks) and 108 full term comparison children (gestational age 37-40 weeks) at age 4 years (corrected for extent of prematurity at birth). The aims of this study were 1) to examine the social competence of a regional cohort of children born very preterm and full term comparison children at age four years, 2) to identify infant clinical factors and socio-familial characteristics associated with poor social competence amongst children born very preterm, and 3) to examine the predictive validity of social competence problems amongst both very preterm and full term preschoolers in relation to school academic functioning and behavioural adjustment at age 6 years.

At age 4, children were assessed using a range of parent and/or teacher completed questionnaires, spanning emotional regulation, behavioural adjustment and interpersonal social behaviour. Measures included the Emotion Regulation Checklist, the Infant-Toddler Symptoms Checklist, the Strengths and Difficulties Questionnaire, the Behaviour Rating Inventory of Executive Functioning – Preschool version and the Penn Interactive Peer Play Scale. In addition, as part of a structured research assessment, children completed a battery of false belief tasks and a short form version of the Weschler Preschool and Primary Scales of Intelligence. Two years later at age 6, school teachers qualitatively rated children's behavioural

adjustment and academic achievement in math, reading, spelling and language comprehension compared to their classroom peers.

Results showed that relative to their full term peers, some children born very preterm tended to score less well across several areas of social competence. Specifically, parent report showed that children born very preterm were more likely to be characterised by higher levels of emotional dysregulation ( $p=.002$ ) as well as a range of behavioural adjustment problems, spanning inhibitory control problems ( $p=.03$ ), hyperactivity/inattention ( $p=.01$ ), conduct problems ( $p=.01$ ) and emotional symptoms ( $p=.008$ ). While elevated rates of behavioural adjustment difficulties were also evident amongst very preterm children within the preschool environment, group differences were not statistically significant. However, a statistical trend towards elevated risk of inhibitory control problems amongst very preterm children in the preschool environment was noted ( $p=.09$ ). Further, children born very preterm were at around a four-fold risk of emotional regulation difficulties of clinical significance, as well as being around 1.5 times more likely to exhibit clinically significant externalising and internalising behavioural difficulties and interpersonal social problems at age 4 years. In contrast, the interpersonal social behaviours and the extent of social cognitive understanding were largely similar across both groups. This pattern of findings remained largely unchanged following statistical control for the selection effects of family socio-economic status.

Amongst children born very preterm, significant infant clinical and socio-familial predictors of both emotional dysregulation and externalizing behaviour were male gender ( $p=.008/p=.006$ ), neonatal indomethacin ( $p=.002/p=.005$ ) and elevated maternal anxiety ( $p=.009/p=.002$ ). Emotional dysregulation was also predicted by low socio-economic status ( $p=.002$ ). In contrast, internalising behaviour was predicted only by low birth weight ( $p=.03$ ).

Finally, across both groups significant associations were found between overall social competence problems at age 4 years and later school adjustment with those very preterm and full term preschoolers characterised by poor social competence being at elevated risk of a range of behavioural adjustment difficulties and poor academic functioning in reading, spelling and math at age 6 years (corrected). Links between poor social competence and later behavioural adjustment remained across both groups following statistical control for child IQ, while associations with academic functioning were largely attenuated.

By age 4 years a number of very preterm children are beginning to display elevated levels of emotional dysregulation, hyperactivity/inattention, conduct problems and emotional symptoms. Further, a substantial proportion of very preterm children may be at risk of developing clinically significant difficulties with these most pronounced in terms of emotional regulation abilities. Children's abilities to regulate their emotions and behaviour represent important building blocks for their later social and emotional functioning. Further, these abilities will likely influence the extent to which children are able to successfully transition to school. Therefore, alongside other important aspects of development, these findings highlight the importance of monitoring the social abilities of preschoolers who were born very preterm across a range of developmental domains and contexts. Preschoolers characterised by emotional, behavioural and/or interpersonal difficulties could then receive targeted intervention aimed at facilitating their social competence prior to school entry.

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## List of Abbreviations

ADDH	Attention Deficit Disorder with Hyperactivity
ADHD	Attention Deficit Hyperactivity Disorder
AGA	Appropriate for Gestational Age
BPD	Bronchopulmonary Dysplasia
BRIEF-P	Behaviour Rating Inventory of Executive Function – Preschool
BW	Birth Weight
CI	Confidence Interval
CLD	Chronic Lung Disease
CPAP	Continuous Positive Airways Pressure
ELBW	Extremely Low Birth Weight
EPT	Extremely Preterm
ERC	Emotion Regulation Checklist
FT	Full Term
GA	Gestational Age
GMI	Grey Matter Injury
HADS	Hospital Anxiety and Depression Scale
ICC	Intraclass Correlation Coefficient
ITSC	Infant-Toddler Symptom Checklist
IUGR	Intra Uterine Growth Restriction
IVH	Intraventricular Hemorrhage
LBW	Low Birth Weight
MRI	Magnetic Resonance Imaging
NBW	Normal Birth Weight
NEC	Necrotising Enterocolitis

NICU	Neonatal Intensive Care Unit
NS	Non Significant
OR	Odds Ratio
PCA	Principle Component Analysis
PDA	Patent Ductus Arteriosus
PIPPS	Penn Interactive Peer Play Scale
PT	Preterm
PVL	Periventricular Leukomalacia
ROP	Retinopathy of Prematurity
SD	Standard Deviation
SDQ	Strength and Difficulties Questionnaire
SES	Socio-Economic Status
SGA	Small for Gestational Age
SPSS	Statistical Package for the Social Sciences
ToM	Theory of Mind
VLBW	Very Low Birth Weight (<1,500 grams)
VPT	Very Preterm (28-33 weeks gestation)
W-J	Woodcock-Johnson
WMI	White Matter Injury
WPPSI-R	Wechsler Preschool and Primary Scales of Intelligence – Revised

## Prologue

The introduction section of this thesis is organised into four chapters.

*Chapter 1* briefly provides an overview of the definitions pertinent to this work, as well as the prevalence, causes and health and social relevance of very preterm birth. The implications of very preterm birth for subsequent neurological and cognitive development are also discussed

*Chapter 2* defines and conceptualises social competence. This is followed by a review of the manner in which social competence typically develops in children during infancy and early childhood.

*Chapter 3* reviews literature examining the social competence of infants and preschoolers born prematurely. Consistent with the conceptual model developed in this dissertation, four aspects of social competence are considered. These include emotional regulation, behavioural adjustment, interpersonal social behaviour and social cognition.

*Chapter 4* discusses key causal processes that may help to explain increased risks of social competence difficulties amongst children born very preterm.

## Chapter 1

### An Overview of Prematurity

Throughout the Western world, an increasing number of infants are being born prematurely (Fox, 2002; Martin et al., 2008; Ventura, Martin, Curtin, Menacker, & Hamilton, 1999). For example, in the United States preterm births represent an increasing percentage of all live births from 9.4% in 1981 to 12.5% of live births being premature in 2004 (Hoyert, Mathews, Menacker, Strobino & Guyer, 2006; Ventura et al., 1999). Associated survival rates are also on the increase as a consequence of improvements in neonatal care, with around 90% of infants born preterm now surviving (Hack & Fanaroff, 1999; Taylor, Klein, & Hack, 2000a). The most dramatic improvements in survival rates are evident amongst those infants born at lower gestational ages (Hack, Breslau, Aram, Weissman, Klien & Boraswki-Clark, 1992; Hack & Fanaroff, 1999; Saigal & Doyle, 2008). Subsequently, escalating numbers of increasingly preterm infants are graduating from intensive care units and these figures seem unlikely to decrease with the underlying cause/s of many very preterm births remaining largely unknown (Goldenberg, Culhane, Lams, & Romero, 2008; Wang, Xie, & Dey, 2008).

It is within this context that there is mounting concern about the associated health and social costs and the long-term developmental consequences of premature birth. For example, preterm birth rates are the strongest predictor of hospital inpatient service costs in the United Kingdom (Petrou, Mehta, Hockley, Cook-Mozaffari, Henderson & Goldacre, 2003), while in the United States preterm infants account for 50% of infant hospitalisation costs and 25% of total paediatric costs (Russell, Green, Steiner, Meikle, Howse, Poschman, et al., 2007). However, the greatest long-term financial costs of very preterm birth are likely to be faced by the education system given that school children born preterm are 50% more likely than their full term



counterparts to require special educational services (Bhutta, Cleves, Casey, Cradock, & Anand, 2002; Petrou, Henderson, Bracewell, Hockley, Wolke & Marlow, 2006). Clearly, research aimed at both increasing understanding of the specific developmental problems facing the preterm infant and reducing the impact of these difficulties on families and society is of high importance.

Prior to the 1990's extent of prematurity was predominantly defined on the basis of birth weight (Hack & Fanaroff, 1988), with the World Health Organisation outlining three clinical categories. These included: low birth weight (LBW; <2,500 g); very low birth weight (VLBW; <1,500 g) and extremely low birth weight (ELBW; <1,000 g) (Wardlaw, Blanc, Zupan, & Ahman, 2004). At this time, birth weight was considered to be a more reliable measure of gestational age as the use of early ultrasound confirmation was less common and postnatal assessments were considered unreliable (Hack & Fanaroff, 1999). However, the use of birth weight criteria was inherently flawed due to the likelihood of including in preterm samples those infants who may have been born at higher gestational ages yet who were characterised by intrauterine growth restriction (IUGR) or who were small-for-gestational age (SGA) (Hack, 2006). Therefore, over time the confounding risks of including infants with higher gestational ages within preterm samples combined with an increasing number of preterm infants surviving at the gestational limits of viability led to a decline in the popularity of using birth weight as a criterion for prematurity. It was now becoming increasingly important for better understanding of the developmental consequences of being born at a low gestational age rather than at a low birth weight. As a result, recent studies now typically define prematurity on the basis of gestational age: preterm <37 weeks gestation (Assel, Landry, Swank, Steelman, Miller-Loncar & Smith, 2002; Paludetto, 1982; Tessier, Nadeau, Boivin, & Tremblay, 1997); very preterm <33 weeks gestation (Als, Duffy, & McAnulty, 1988; Delobel-Ayoub, Kaminski, Marret, Burguet,

Marchand, N'Guyen, et al., 2006); and extremely preterm <28 weeks gestational age (Anderson & Doyle, 2003; Hoff, Hansen, Munck, & Mortensen, 2004).

While the interpretation of the preterm literature is somewhat hampered by such definitional inconsistencies, early research efforts predominantly focused on the extent to which those born very preterm or very low birth weight were at elevated risk of severe neurodevelopmental disabilities. Findings demonstrate that the improving survival rates of infants born very preterm have not been accompanied by reductions in neonatal morbidity. Specifically, between 5-20% of infants born very preterm have severe neurodevelopmental problems (Cooke, 2005; Hack & Fanaroff, 1999; Hack & Fanaroff, 2000; Piecuch, Leonard, Cooper, Kilpatrick, Schlueter & Sola, 1997; Saigal & Doyle, 2008), with these difficulties spanning cognitive, motor and sensory domains.

In terms of cognitive development, those born very preterm are at elevated risk of severe impairment with a recent review suggesting that 10-35% of extremely preterm children will be characterised by severe intellectual impairment defined on the basis of normative data and/or the distribution of comparison control group scores (Anderson & Doyle, 2008). In terms of physical disabilities, the major disabling neuromotor outcome following very preterm birth is cerebral palsy, with 5-15% of children born preterm characterised by spastic motor deficits (Bracewell & Marlow, 2002; Hack & Fanaroff, 1999; Moster, Lie, & Markestad, 2008). The description of these deficits may reflect motor impairment regarding movement (such as spastic or athetoid cerebral palsy) or specific body parts (hemiplegia, diplegia, and quadriplegia). Children born very preterm are also at elevated risk of compromised physical growth (Euser, de Wit, Finken, Rijken, & Wit, 2008; O'Shea, Klinepeter, Goldstein, Jackson, & Dillard, 1997; Taylor et al., 2000a).

In terms of associated sensory integration difficulties, higher rates of sensory handicaps in hearing and vision are also common (Davis, Ford, Anderson, & Doyle, 2007; Doyle & Casalaz, 2001; Saigal & Doyle, 2008; Saigal, Stoskopf, & Boyle, 2007; Vohr, Wright, Dusick, Mele, Verter, Steichen, et al., 2000). For example, 3% of infants born at <28 weeks gestation will require hearing aids by 18 months of age, while around 11% of these infants will have mild hearing impairment or high frequency hearing loss (Vohr et al., 2000). Ophthalmic problems associated with prematurity include amblyopia, strabismus, refractive disorders, cortical visual impairment and most commonly retinopathy of prematurity (Brophy-Herb, Lee, Nievar, & Stollak, 2007) (for further detail see Repka, 2002).

Despite clear evidence that children born very preterm are at elevated risk for a range of severe, and often comorbid, neurodevelopmental outcomes until recently much less attention has been given to the less severe, but nonetheless important, developmental and clinical challenges facing this unique population of high risk children. These difficulties amongst very preterm children have been referred to as higher prevalence/lower severity disorders (Aylward, 2002). One developmental area, in particular, which has been largely neglected to date and which is of great importance during the early childhood period concerns that of social competence. Very little is known about the early social abilities of children born very preterm and in particular the extent to which very preterm children may be characterised by greater difficulties in behavioural adjustment, emotional regulation, interpersonal social behaviour and social cognition. Consequently, in an effort to address this gap in the current literature and to stimulate further research interest in this important area, the primary focus of the current study was to examine the social competence of preschool children born very preterm. A brief overview of the broader range of less severe but clinically

significant developmental difficulties is given below to provide some context for the present study.

### *1.1 Cognitive Outcomes*

One of the most well studied outcomes associated with very preterm birth are those relating to cognitive functioning. It is well established that children born very preterm are at risk of delayed intellectual functioning with these difficulties evident across all developmental periods (Allin, Walshe, Fern, Nosarti, Cuddy, Rifkin et al., 2008; Aylward, Pfeiffer, Wright, & Verhulst, 1989; Bhutta, Cleves, Casey, Cradock & Anand, 2002; Escobar, Littenberg, & Petitti, 1991; Hall, Counsell, Thomson, & Mutch, 1995; Saigal, Hoult, Streiner, Stoskopf, & Rosenbaum, 2000; Sansavini, Guarini, Alessandroni, Faldella, Giovanelli & Salviolo, 2007; Taylor et al., 2000a). While preschoolers born very preterm are more likely than their full term counterparts to achieve a lower mean intelligence quotient score (Briscoe, Gathercole, & Marlow, 1998), associations between very preterm birth and compromised cognitive functioning are especially evident following the transition of these children to school (Anderson & Doyle, 2003; Böhm, Katz-Salamon, Smedler, Lagercrantz, & Forssberg, 2002; Hack, Taylor, Drotar, Schluchter, Cartar & Andreias, 2005; Johnson, 2007; Marlow, Wolke, Bracewell, & Samara, 2005). For example, Johnson (2007) recently reviewed studies examining the cognitive outcomes of very preterm school children born following the widespread introduction of antenatal steroids, surfactant therapy and improved respiratory support (Johnson, 2007). While these medical advances were expected to facilitate improved developmental outcomes (Foulder-Hughes & Cooke, 2003; Hack & Fanaroff, 1999), this review showed that very preterm children continued to have significantly lower IQ scores than full term born children (Delobel-Ayoub et al., 2006).

Further, those studies reviewed showed that the IQ scores of very preterm children were 11 to 24 points lower than full term comparison children across the middle childhood period (Anderson & Doyle, 2003; Böhm, Katz-Salamon, Smedler, Lagercrantz & Forssberg, 2002; Foulder-Hughes & Cooke, 2003; Hack et al., 2005; Larroque, Marchand, & Kaminiski, 2005; Marlow et al., 2005; Mikkola, Ritari, Tommiska, Salokorpi, Lehtonen & Tammela et al., 2005). A more recent study by Bayless, et al. (2008), using the Wechsler Intelligence Scale for Children (WISC-III; Wechsler, 1992) to compare the IQ scores of 69 very preterm and 70 full term counterparts at a mean age of 8.68 years ( $SD=1.85$ ) found that those born very preterm scored significantly lower with a group mean IQ score of 98.40 versus a comparative score of 105.64 in the control group (Bayless, Pit-ten Cate, & Stevenson, 2008). Importantly, very preterm children at elevated risk of poor cognitive development are not limited to those with major neurological and/or physical impairment. Rather, very preterm children free from significant disability have been found to be at similar risk (Aylward, 2002; Caravale, Tozzi, Albino, & Vicari, 2005).

### *1.2 Language Outcomes*

Recently it has been acknowledged that children born very preterm are also at elevated risk of a range of language difficulties (Foster-Cohen, Edgin, Champion, & Woodward, 2007; Sansavini et al., 2007). During the early childhood period, these difficulties include: a smaller vocabulary, compromised quality of word use, a lack of syntactic complexity (Foster-Cohen et al., 2007); poorer receptive and expressive language (Briscoe et al., 1998; Vohr, Coll, & Oh, 1988); and difficulties with phonological processing (Sansavini et al., 2007), language comprehension (Landry, Miller-Loncar, & Smith, 2002) and articulation (Largo, Molinari, Kundu, & Duc, 1990). Associations between very preterm birth and language difficulties are also

evident during middle childhood. For example, a study by Wolke and Meyer (1999) of 264 very preterm and 264 full term children at age 6 years using four subtests from a German test battery for language development (the Heidelberger Sprachentwicklungstest; Grimm & Schöler, 1990) found that very preterm children performed less well than full term children on all language subscales (Wolke & Meyer, 1999). Specifically, very preterm children had greater difficulty with grammatical rules, poor word articulation, and were less likely to detect semantically incorrect sentences. Further, this study showed that very preterm children had poorer total language scores and were more likely than full term children to exhibit serious language impairment. Further, the results of this study suggest that the language deficits amongst school children born very preterm are unlikely to be the direct result of poor intellectual functioning as all between group differences remained statistically significant following the exclusion of those children with major intellectual impairment ( $\geq 2$  SD; defined based on the full term sample) from the analyses.

### *1.3 Learning and Educational Outcomes*

In keeping with evidence of compromises in cognitive and language development, school children born very preterm also present with high rates of learning problems and educational difficulties. More than 50% of VLBW and 60%-70% of ELBW school children require special educational assistance in the classroom (Aylward, 2002). A study by Taylor, et al. (2006), for example, examining 219 ELBW children at age 8 years found that compared to their full term counterparts these children were at least five times more likely to require participation in special education programs (Taylor, Klein, Drotar, Schluchter, & Hack, 2006).

Particular areas of academic difficulty, which have been noted across development, include reading, writing, language comprehension, handwriting, spelling

and numerical skills (Botting, Powls, Cooke, & Marlow, 1998; Grunau, Whitfield, & Fay, 2004; Horwood, Mogridge, & Darlow, 1998; Klein, Hack, & Breslau, 1989; Litt, Taylor, Klein, & Hack, 2005; Pritchard, Clark, Champion, Wilson, Liberty & Woodward, 2008; Ross, Lipper, & Auld, 1991). Further, several recent studies have suggested that educational difficulties amongst school children born very preterm may be particularly marked in math (Pritchard et al., 2008; Rodrigues, Mello, & Fonseca, 2006).

The widespread nature of academic difficulties associated with prematurity is of concern, particularly as many very preterm children will experience persistent and potentially compounding learning difficulties over time (Botting et al., 1998; Rickards, Kelly, Doyle, & Callanan, 2001; Rickards, Ryan, & Kitchen, 1988; Schraeder, Heverly, O'Brien, & Goodman, 1997), therefore increasing the likelihood that for some of these children, academic difficulties may increase with age (Aylward, 2002; Carran, Scott, Shaw, & Beydouin, 1989; Horwood et al., 1998; McCormick, Gortmaker, & Sobol, 1990; O'Brien, Roth, Stewart, Rifkin, Rushe & Wyatt, 2004; O'Callaghan, Burns, & Gray, 1996; Rickards, Kelly, Doyle, & Callanan, 2001; Schothorst & van Engeland, 1996). For example, a study by O'Brien et al. (2004) examining a cohort of 151 very preterm children at ages 8 and 14-15 years noted that across age there was a 9% increase in the need for additional educational assistance while the percentage of children receiving satisfactory achievement ratings from their teachers dropped from 74% to 64% (O'Brien et al., 2004). These results suggest that the educational gap between very preterm and full term children may widen as academic demands increase, thereby supporting the 'Matthew Effect' as children with strengths continue to make significant gains while those with challenges get progressively worse (Stanovich, 1986).

#### *1.4 Behaviour and Mental Health Outcomes*

School children born very preterm may also exhibit high rates of behavioural, emotional and mental health issues, especially attention problems. For example, a recent meta-analysis conducted by Bhutta, et al. (2002) showed that very preterm children were 2.6 times more likely than their full term peers to exhibit attention deficit/hyperactivity disorder (ADHD) (Bhutla et al., 2002). In contrast, however, some very preterm children are characterised by elevated rates of inattention in the absence of hyperactivity (Bhutla et al., 2002; Hack, Taylor, Klien, Eiben, Schatschneider & Mercuri-Minich, 1994), which may indicate a ‘pure’ attention deficit amongst these children (Wolke, 1998). Very preterm birth has also been linked to more internalising and externalising behavioural disorders during middle childhood, with 81% of the studies reviewed by Bhutta et al. (2002) revealing an excess of behaviour problems in school children born very preterm (Bhutla et al., 2002). Importantly, elevated rates of behavioural adjustment difficulties continue to be apparent during later developmental periods. A study by Grunau, et al. (2004), for example, compared the behavioural adjustment of 53 ELBW and 31 full term comparison adolescents at age 17 years using the parent report version of the Child Behavior Checklist (Achenbach, 1991c) and found that ELBW teens had elevated rates of both internalising and externalising behaviour problems (Grunau, Whitfield & Davis, 2004). Specifically, adolescents born ELBW were characterised by more inattention, greater social withdrawal, more delinquency and aggression. While links between very preterm birth, adverse behavioural adjustment and poor mental health outcomes are often apparent amongst older children, much less is known about the extent to which these difficulties are evident and detectable earlier in the development of children born very preterm.



### *1.5 Social Functioning Outcomes*

Despite links between very preterm birth and increased risks of severe compromise across a number of neurodevelopmental domains, relatively little is known about the social abilities of children born very preterm. However, it would seem quite feasible that very preterm children who are at an increased risk of developmental impairment may also be characterised by poor social functioning. Examination of the social development of children born very preterm will be important as evidence in the mainstream literature has shown that the adverse consequences of poor social competence during childhood may be widespread and long lasting, particularly with regard to school outcomes. For example, children who are unable to function effectively on a social basis may be more disengaged, noncompliant and socially isolated at school (Raver, 2002; Rubin & Mills, 1988). In turn these difficulties may contribute to elevated risks of on-going behavioural problems, academic failure, peer rejection, negative school perceptions, delinquency and school avoidance or drop out (Arnold, Ortiz, Curry, Stowe, Goldstein & Fisher et al., 1999; Hymel, Rubin, Rowden, & Le Mare, 1990; Ladd, 1990; Vitaro, Larocque, Janosz, & Tremblay, 2001). Further, a study by Hair, et al. (2006) examined a nationally representative sample of 17,219 new entrance school children at a mean age of 5.68 years using the National Education Goals Panel (Kagan, Moore, & Bradekamp, 1995) as a framework for school readiness (Hair, Tamara, Terry-Humen, Lavelle, & Calkins, 2006). Results showed that those children experiencing social-emotional difficulties, such as externalising and internalising behaviour problems, poor interpersonal social skills and self-regulation difficulties were more likely to be characterised by poor math and reading abilities, lower self-control, and were less likely to work their to best ability compared to children characterised by better social-emotional development. Subsequently, children's abilities to successfully interact with both school peers and

teachers have been increasingly recognised as important to effective learning and success in the school environment (Landry, Smith, Swank, & Miller-Loncar, 2000; Shonkoff & Phillips, 2000). Further, levels of social functioning during the early childhood years have been acknowledged as important contributors to children's later school readiness (Hair et al., 2006; Ladd, Herald, & Kochel, 2006; Mashburn & Pianta, 2006; Pears, Fisher, & Bronz, 2007).

While some debate exists, the concept of school readiness generally suggests that most 5-year-old children have reached a developmental level conducive to meeting the academic, behavioural, emotional and social challenges of formal schooling (Ladd et al., 2006). However, recent evidence has suggested that up to 50% of children entering their first year at school are not ready to learn, due in part to inadequate cognitive and/or social skills (Ewing Marion Kauffman Foundation, 2002). This figure is alarming as early school success is important for later academic functioning, with children's achievement trajectories considered to be very stable by first grade (Entwisle & Hayduk, 1988). Therefore, it may be preferable that efforts to improve children's school functioning take place prior to school entry.

Clearly, early social capabilities make an important contribution to children's subsequent transition to formal schooling, academic achievement, social relations, behaviour and, likely, mental well-being. As children born very preterm have been recognised as a population who may be at an elevated risk for educational and learning difficulties, the importance of examining the social competence of this sample prior to school entry becomes clear. Specifically, a better understanding of the social competence of preschoolers born very preterm may identify opportunities for intervention efforts aimed at facilitating the extent to which these children start school ready to learn.

*Summary of Prematurity Overview*

It has been well established that children born very preterm are at elevated risk of severe neurodevelopmental problems, spanning physical, sensory and cognitive impairments. However, less is known about the higher prevalence/lower severity difficulties that may also be associated with prematurity and which may affect the life course opportunities of an even greater number of children born very preterm. One important aspect of development that has been neglected concerns the social, emotional and behavioural outcomes associated with very preterm birth, particularly during the early childhood period. The present study seeks to address this important gap in the literature by undertaking a systematic examination of a broad range of social competencies amongst preschool children born very preterm, the identification of risk factors for poor social competence, and the implications of social competence difficulties with regard to later school functioning. Further, as will be highlighted in Chapter 3, while a number of studies have suggested potential links between prematurity and various aspects of social competence, their interpretation is limited by several methodological concerns and none represent a comprehensive study of a wide range of emotional, behavioural and interpersonal indicators of social competence within a single research design. Moreover, no studies to date have examined the potential relations between overall functioning across a broad range of social domains and later school adjustment in very preterm cohorts.

## Chapter 2

### **Social Competence in the Early Childhood Period: Conceptualisation and Development**

Clear links have been established between very preterm birth and an increased risk of a range of severe neurodevelopmental challenges. However, comparatively little research attention has been given to the social development of children born very preterm, particularly within the very important early childhood period. Central to a comprehensive examination of the early social competence of children born very preterm is the need for a clear conceptualisation of this important construct and its various components, as well as understanding the emergence of early social competence amongst typically developing children. Therefore, in this chapter key constructs are defined and a conceptual framework is proposed that might assist in the study of early developing social competence. A brief overview is then provided of the age-typical development of social competence during infancy and the early childhood years.

#### *2.1 Social Competence Defined*

While definitions of social competence vary widely across studies, this construct is commonly thought to reflect the extent to which an individual is able to effectively function in social relationships (Bukowski, Rubin, & Parker, 2001). Children who are socially competent, for example, tend to make and maintain friendships easily, are socially accepted and in general are capable of developing and successfully implementing a range of interpersonal skills that are important for social relations with others (Berndt & Burgoyne, 1996; Rose-Krasnor, 1997). These latter interpersonal skills may include the display of socially appropriate emotions and

behaviour, the ability to effectively solve social and interpersonal problems, the capacity to process and act on socially relevant information in a timely manner (i.e., executive functioning) and a degree of social cognition (i.e., theory of mind) (Guralnick, 1999; Masten, Hubbard, Gest, Tellegen, Garmezy & Ramirez, 1999; Yeates, Bigler, Denniss, Gerhardt, Rubin, Stancin et al., 2007). As such, it is generally agreed that social competence is an important aspect of children's development that may be defined as a broad construct encompassing a wide array of behaviours, many of which overlap (Saylor, Boyce, & Price, 2003).

It was within this context that the current study commenced with a review of the mainstream developmental literature concerned with the emergence of social competence during the early childhood period. This was undertaken in order to gain a better understanding of the particular aspects of social competence that are important to consider when studying preschool-aged children. Subsequent to this review, it became apparent that while a range of aspects or domains of social competence were examined in the literature, rarely were multiple aspects of social competence investigated within a single study design. Rather, the majority of studies reviewed tended to adopt a relatively narrow conceptualisation of social competence, focusing on a single aspect or a small set of domains indicative of children's early social functioning capabilities. Specific aspects of social competence typically examined spanned social cognition (Baetz, 2004; Symons, 2004), peer relations (Fogle, 2004; Gleason, 2004; Kilgore, 2004; Miller, Gouley, Seifer, Dickstein, & Shields, 2004), interpersonal social behaviours (Driscoll & Carter, 2004), socio-emotional development (Gagnon & Nagle, 2004), aggression (Diener & Kim, 2004; Ostrov, 2004), disruptive behaviour (Greenfield, Iruka, & Munis, 2004), externalising and internalising behaviours (Pihlakoski, Aromma, Sourander, Rautava, Helenius &

Sillanpaa, 2004), compliance (Kotler & McMahon, 2004), prosocial behaviours and social withdrawal (Diener & Kim, 2004).

However, several exceptions to this typically narrow conceptual approach are worthy of note as such studies highlighted both the emergence of a broader approach to the examination of social competence and the extent to which many aspects of social functioning during early childhood may be interrelated. For example, a study of 4-5 year old children examined a range of social competencies, including prosocial behaviour, popularity with peers and the extent of externalising behaviours and aggression (Liew, Eisenberg, & Reiser, 2004). An additional strength of this study was the use of multiple report sources thus minimising the effects of situational bias. Using a composite measure of social competence, based on parent, teacher and peer report, this study demonstrated clear links between children's overall level of perceived interpersonal social behaviour and aspects of children's regulatory capabilities and behavioural adjustment. Specifically, children characterised by better social functioning were more likely to exhibit high levels of attention, greater emotional regulation and more inhibitory control across both the home and preschool environments. Therefore, by examining a broad range of social competencies this study provided a more in-depth understanding of the early social capabilities of preschool-aged children and was also able to demonstrate the interrelatedness of several socially relevant emotional, behavioural and interpersonal constructs.

Evidence of a broader approach to the conceptualisation of social competence was also apparent in a study by Blair, et al. (2004) that examined a number of social competencies in preschool aged children (Blair, Denham, Kochanoff, & Whipple, 2004). In contrast to Liew's (2004) study, however, differing competencies were examined in Blair's (2004) study, including emotional regulation strategies used for the management of negative affect, externalising and internalising behaviours and

aspects of interpersonal social functioning, such as comforting or assisting other children. Based on parent and teacher report, the results showed that the emotional regulation strategies adopted by preschool-aged children were predictive of concurrent externalising and internalising behavioural outcomes. However, across studies it was also evident that there was a general lack of consensus concerning the specific aspects of social competence that should be examined during this important developmental period. Competencies examined varied across studies, spanning social cognition, interpersonal social behaviours, emotional and behavioural adjustment.

Alongside consideration of the available mainstream developmental literature, the current study author also reviewed and evaluated existing conceptual models of social competence. Models identified were required to meet the following four criteria: to be suitable for use with preschool-aged children; to adopt a broad conceptual focus; to be accompanied by empirical support; and to be grounded in developmental theory. Subsequently, it became evident that few such models were available at this time. One model considered was Gurtman's Circumplex Model of Social Competencies (Gurtman, 1999), which was based on an earlier reformulation of the concept of social competence (McFall, 1982). Gurtman's circular model provided a descriptive framework for the examination of social competence as a global construct consisting of a range of social competencies. More specifically, Gurtman proposed that all interpersonal aspects of social competence could be conceptually placed within one of the following eight categories: Dominance; Extraversion; Friendliness; Deference; Submission; Avoidance; Hostility; and Exploitation. Each of these categories represented a particular octant region of the circular model.

This model also offered examples of specific behaviours that may comprise a given category of competence. For example, it was suggested that the category of 'Dominance' may consist of social behaviours such as making reasonable requests of

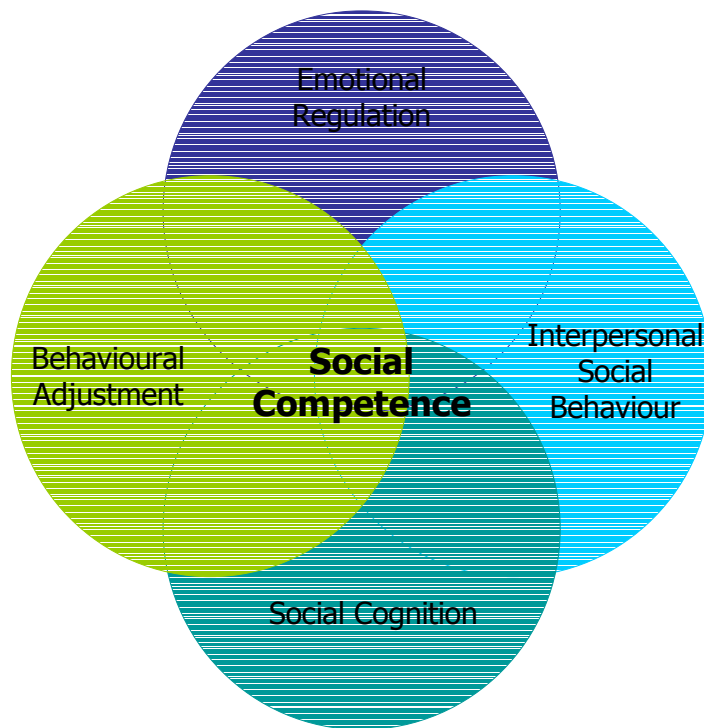
others, challenging people when the situation calls for it, standing up for oneself, expressing one's needs directly to others and/or refusing to comply with unreasonable requests. In this way, Gurtman's model offered greater specificity than previously available models of social competence. Further, Gurtman's model made claims concerning the extent to which aspects of social competence were interrelated. In particular, the proximity of the individual aspects of social competence to each other in the model reflected the extent to which constructs were deemed related. For example, the competencies of 'Submission' and 'Avoidance' were located next to each other in order to reflect greater similarity, whilst the less closely related competency of 'Dominance' was located on the opposite side of the circular model. In sum, Gurtman's model highlighted the importance of undertaking a broad approach to the study of social competence, offered examples of specific social behaviours that may be representative of an individual's competency in each specified domain, and recognised the interrelatedness of these competencies.

However, one particular shortcoming of Gurtman's model is worthy of note. Specifically, this model did not accommodate all capabilities that have traditionally been linked to social competence, with important competencies such as the capacity for social cognitive understanding and the ability to appropriately regulate one's emotions being poorly represented. Gurtman acknowledges this shortcoming and recognises the limitations of a model that is essentially based on the examination of an individual's behavioural responses to social interaction rather than on their ability to effectively function within and contribute to bi-directional social relationships (Gurtman, 1999). This omission, along with the conceptual inconsistencies evident following the careful review of the relevant mainstream developmental literature and associated discussions with colleagues led to the decision to develop and tentatively propose my own conceptual framework of social competence for application in this



dissertation. The proposed framework was based on the following four key developmental domains that were to some extent commonly acknowledged as being indicative of social competence; 1) emotional regulation, 2) behavioural adjustment, 3) interpersonal social behaviour and 4) social cognition (see Figure 2.1).

*Figure 2.1 Proposed Conceptual Developmental Framework of Early Social Competence*



This framework has several important distinctions from Gurtman's model. Specifically, no claims or assumptions are made concerning the extent to which each of the four domains of social competence may be interrelated. Rather, within this framework, children's capacities for the successful regulation of their emotions, to display appropriate behavioural adjustment, to interact positively with other people, and to utilise social cognitive skills are considered to similarly contribute to their development of social competence. In addition, the model I proposed incorporated two further fundamental social abilities that were not well provided for in Gurtman's

model. These were children's capacities for the regulation of emotion and the extent of their social cognitive understanding, both of which have been recognised as important to the development of children's social competence (Denham & Burton, 2003; Eisenberg, 2002; Hoffman, 2000; Slaughter, Dennis, & Pritchard, 2002; Thompson & Goodvin, 2007).

More recently, this proposed conceptual framework was re-examined in relation to developmental studies of social competence in preschool-aged children published over the past two years. This review showed that, compared to the relatively narrow conceptual focus noted in the earlier literature review, a greater proportion of studies now adopt a broader conceptualisation of children's social competencies (Baillargeon, Normand, Seguin, Zoccolillo, Japel, Perusse et al., 2007; Brophy-Herb et al., 2007; Lengua, Honorado, & Bush, 2007; Murphy, Laurie-Rose, Brinkman, & McNamara, 2007; Vaughan Van Hecke, Mundy, Acra, Block, Delgado, Parlade et al., 2007; Williams, Ontai, & Mastergeorge, 2007). As detailed in Table 2.1, aspects of early social competence now commonly examined within single study designs span emotional, behavioural and social functioning, and therefore provide some converging support for the theoretical framework of the current study. For example, as shown in Table 2.1, a recent study by Baillargeon, et al. (2007) examined the social capabilities of toddlers' aged 17 and 29 months using measures of oppositional behaviours, inattention and hyperactivity, physical aggression, anxiety, emotional dependence, shyness, sadness and empathy (Baillargeon et al., 2007). The results of this study suggested that it is possible to distinguish a range of social difficulties during the early childhood period, with behavioural and emotional difficulties of clinical significance able to be identified during the preschool period. Consequently, these findings highlighted the importance and ability to examine a range of children's social competencies at earlier rather than at later stages of children's development.

The breadth of such approaches to the study of social competence during the early childhood period is clearly illustrated in Table 2.1 and suggests a shift within the wider literature towards a more comprehensive framework for the examination of social competence within single study designs. This shift is consistent with the conceptual developmental framework proposed in this dissertation. Further, Figure 2.2 summarises how the majority of individual social competencies examined in recent studies may be conceptually linked to the developmental domains of emotional regulation, behavioural adjustment, interpersonal social behaviour and social cognition.

It is also evident from the review of Figure 2.2 that emotional, behavioural and social aspects of children's social competence have been examined across studies. For example, five out of the six studies reviewed examined children's interpersonal social behaviours in the forms of peer competence (Williams et al., 2007), prosocial peer interactions (Vaughan Van Hecke et al., 2007), cooperation (Lengua et al., 2007), peer competence (Murphy et al., 2007) and the examination of social skills with peers (Brophy-Herb et al., 2007). The majority of these studies also included measures of behavioural adjustment, such as physical aggression towards peers (Baillargeon et al., 2007; Williams et al., 2007), externalising behaviour (Vaughan Van Hecke et al., 2007) and aggression (Murphy et al., 2007).

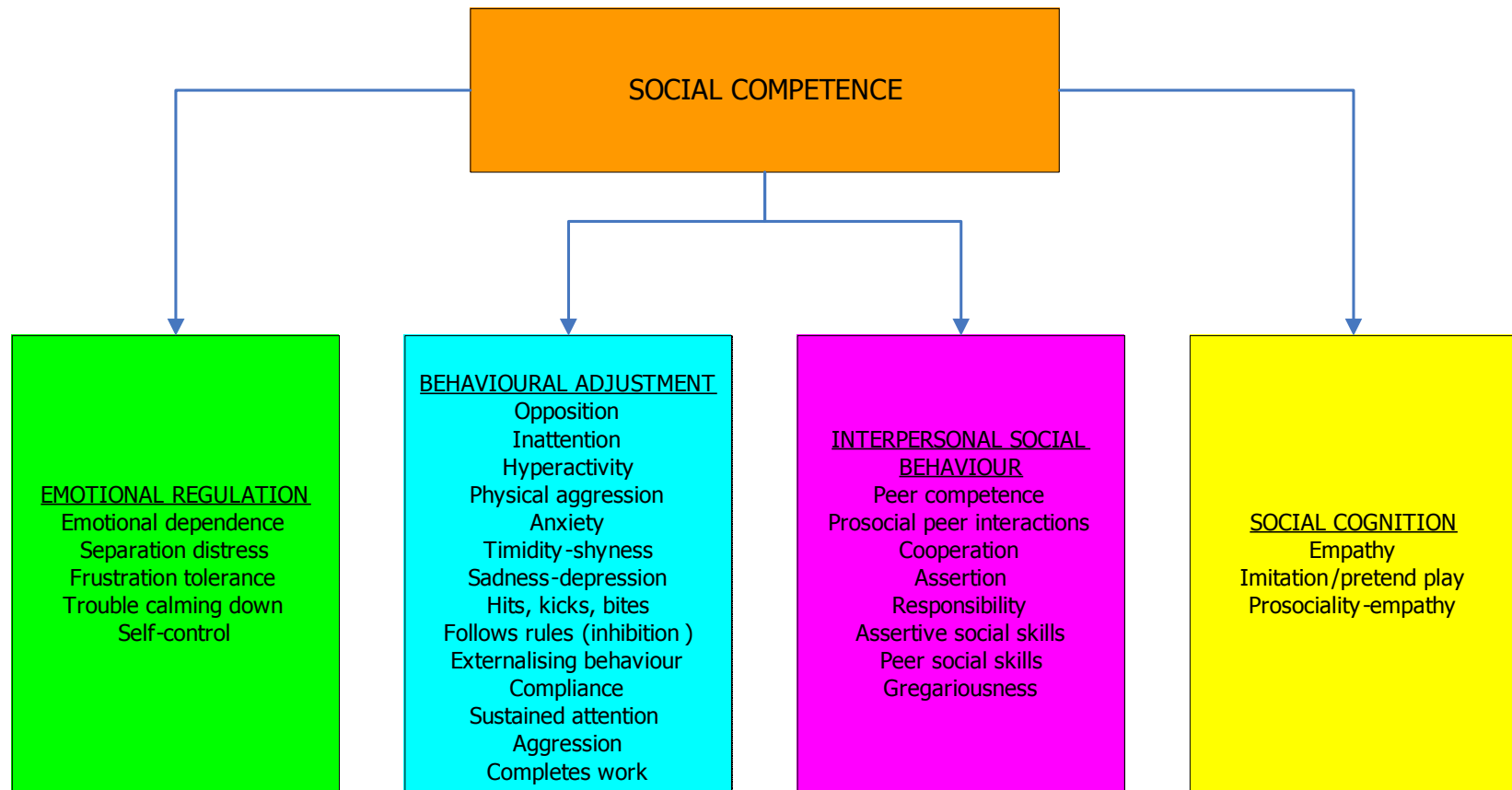
The shift towards the broader conceptualisation of social competence was also evident in the breadth of measures more recently used to examine the development of early social competence, such as the Brief Infant-Toddler Social and Emotional Assessment (Briggs-Gowan, Carter, Irwin, Wachtel, & Cicchetti, 2004), the Howes Peer Play Scale (Howes & Matheson, 1992), the Infant-Toddler Social and Emotional Assessment (Carter, Briggs-Gowan, & Davis, 2004), the Social Skills Rating Scale (Gresham & Elliot, 1990) and the Teacher-Child Rating Scale (Cowen, Hightower,

Pedro-Carroll, Work, Wyman & Haffey, 1996). All of these measures, to some extent, have adopted a broad multi-domain approach by examining children's abilities across a range of key domains implicated in the development of social competence. Together, these more recent trends in the mainstream literature offer some validation for the model of social competence that I developed and proposed as part of this dissertation. The following sections of this chapter outline each of the four developmental domains relevant to children's social competence, and provide an overview of the typical developmental milestones that occur across infancy and the early childhood period.

*Table 2.1 Recently Examined Aspects of Social Competence*

Author/s	Age Seen	Measures of Social Competence	Aspects of Social Competence
Baillargeon, et al. (2007)	17 & 29 months	Items were selected from the Interviewer Completed Computerized Questionnaire based on previous longitudinal studies of social competence during the preschool period	opposition; inattention; hyperactivity; physical aggression toward peers; anxiety; emotional dependence-separation distress; timidity-shyness; sadness-depression; prosociality-empathy
Williams, et al. (2007)	18-23 months	Modified Howes Peer Play Scale Brief Infant Toddler Social Emotional Assessment	peer competence; gregariousness; aggression; object competence social problems (i.e., hits, kicks, bites, trouble calming down) and social competence (i.e., follows rules)
Vaughan Van Hecke, et al. (2007)	30 months	Infant Toddler Social Emotional Assessment	externalising behaviour; compliance; empathy; imitation/pretend play; mastery motivation; sustained attention; prosocial peer interactions
Lengua, et al. (2007)	39-46 months	Social Skills Rating Scale	cooperation; assertion; responsibility; self-control
Murphy, et al. (2007)	3-5 years	Howes Peer Play Scale	peer competence; gregariousness; aggression; object competence
Brophy-Herb, et al. (2007)	3-6 years	Teacher-Child Rating Scale	completes work; frustration tolerance; assertive social skills; peer social skills

Figure 2.2 Recently Examined Key Domains of Social Competence

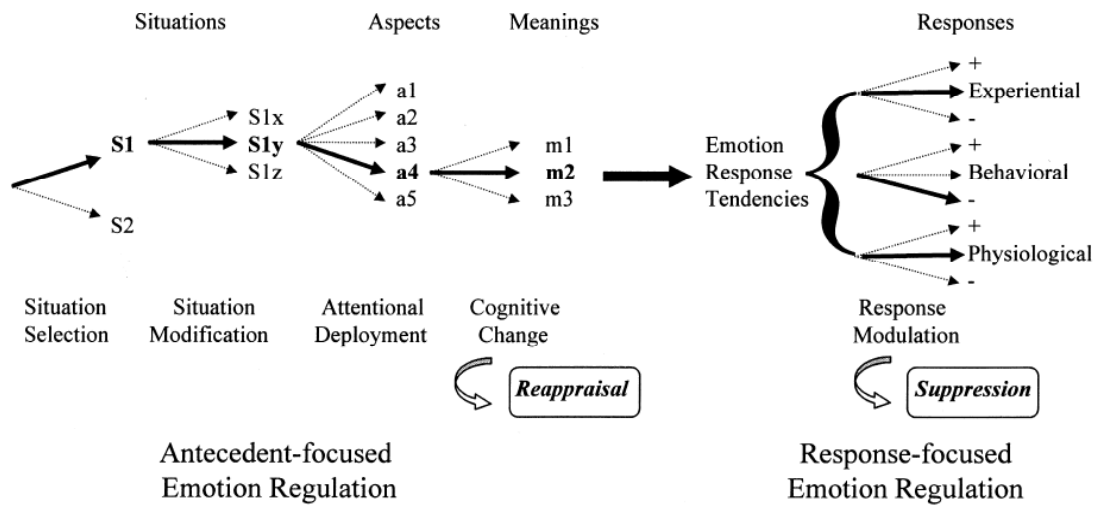


## 2.2 Emotional Regulation

The construct of emotional regulation incorporates a collection of cognitive, physiological and behavioural processes and strategies that are used to manage one's emotions in order to accomplish particular emotional, behavioural and/or social goals (Thompson, 1994). These processes are involved in the evaluation, maintenance, modulation, inhibition and enhancement of emotional experiences (Calkins & Fox, 1994; Kopp, 1982; Thompson, 1994), and may influence the timing, duration, severity and expression of emotions (Gross, 2002). This complex array of processes has led to the development of several explanatory models that attempt to provide an overall framework of emotional regulation (Carver & Scheier, 1982; Gross, 2001; Hwang, 2006; Larsen, 2000).

Figure 2.3, for example, shows Gross' model of emotion regulation which illustrates a number of ways in which an unfolding emotion may be regulated (Gross, 2002). These include *situation selection* (i.e., avoiding certain people in an effort to regulate emotion), *situation modification* (i.e., tailoring a situation in order to modify its emotional impact), *attentional deployment* (i.e., selecting the focal point of a situation) and *cognitive change* (i.e., altering the meaning of a situation). Following the application of such antecedent efforts, a coordinated set of experiential, behavioural and/or physiological responses may be triggered. While Gross' model provides an overview of the processes that may be implicated in the regulation of emotion, it is included here for illustrative purposes only. Specifically, antecedent regulatory efforts, physiological and experiential aspects of emotional regulation will not be examined in the current study. Rather, the focus of the current study will be on those observable and behavioural aspects of emotion regulation such as children's abilities to self-regulate emotional reactions, to recover from stress and/or upset, to change activities without distress and to appropriately manage intense emotions.

Figure 2.3 Gross's (2002) Model of Emotional Regulation



From "Emotion regulation: Affective, cognitive and social consequences", *Psychophysiology*, 39, p. 282. Copyright 2002 by the Society for Psychophysiological Research. Reprinted by permission of the author.

In terms of the development of emotional regulation during infancy and the early childhood period, existing research suggests that these abilities emerge gradually over time, with neonates largely reliant upon the efforts of their caregivers to achieve and maintain emotional regulation (Shonkoff & Phillips, 2000). Such parental efforts would typically take place during an infant's daily activities and within the context of Gross' model may include actions such as placing the infant in familiar surroundings (*situation selection*), with familiar people (*situation modification*), and/or having the infant's favourite toys available (*attentional deployment*). In other words, parental input is required for the undertaking of antecedent efforts to regulate the infant's subsequent emotional responses. However, when aged approximately six months infants' begin to undertake efforts to modify their own emotional behaviour by the use of self-regulation techniques. These may include self-soothing behaviors (i.e., hand to mouth sucking efforts), the use of distraction techniques (i.e., gaze aversion), and/or



the use of significant others to facilitate the regulation of affect (i.e., crawling to mother for a hug when upset) (Rothbart, Ziaie, & O'Boyle, 1992; Siegler, Deloache, & Eisenberg, 2003). The infant is able to develop an increasing repertoire of self-regulation skills on the basis of physiological, neurological, physical and cognitive maturation (Siegler et al., 2003; Thompson & Goodvin, 2007). These developments assist the typically developing infant to exert increasing control over their emotional reactivity.

Beyond infancy, continuing advances in language and cognition foster further developments in children's capacities for emotional regulation (Berk, 2001; Calkins, 2007). Specifically, language developments during the early childhood period enhance children's abilities to talk about their feelings and to avoid conflict via negotiation with adults and peers (Kopp, 1992). Further, both language and cognitive advances may facilitate children's capacities for cognitively based self-regulatory strategies (i.e., Cognitive Change efforts as illustrated in Gross' model) (Kopp, 1992). For example, a child may decide that a favourite yet currently unavailable toy may not actually be the best toy after all. While covered in brief here, many of the foundations of emotional regulation are established within the context of caregiver relationships during the first few years of life (Siegler et al., 2003; Thompson & Goodvin, 2007), making the early childhood years an important developmental period in which to examine these capabilities.

Impairments or delays in the development of the foundations of emotional regulation may have profound behavioural and social consequences. For example, emotional dysregulation during early childhood and beyond has been linked to both externalising and internalising behavior problems, including inattention, non-compliance and poor inhibitory control (Calkins, 2007; Cole, Michel, & Teti, 1994; Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996; Eisenberg, Fabes, Murphy, Maszk,

Smith & Karbon, 1995; Eisenberg, Fabes, Shepard, Murphy, Guthrie & Jones et al., 1997; Rubin, Coplan, Fox, & Calkins, 1995; Shaw, Bell, & Gilliom, 2000). A lack of emotional regulation has also been linked to inappropriate social behaviour and low levels of empathy, as well as poor problem solving capabilities (Cicchetti, Ganiban, & Barnett, 1991; Cole, Michel, & Teti, 1994; Denham & Burton, 2003; Eisenberg, 2002; Thompson & Goodvin, 2007).

As highlighted by this review, there are a number of physiological, cognitive and behavioural processes that are involved in regulating emotions, with children undergoing tremendous change in their capacity to self-regulate during the early childhood period. Given the importance of emotional regulation for later behavioural and interpersonal functioning it seems critical that early developments in this domain undergo close examination in at risk cohorts, particularly those who may be at elevated risk of later learning difficulties. In this dissertation the assessment of emotional regulation during the early childhood period includes, for example, measures of children's abilities to maintain regulation whilst changing activities and to verbally express feelings, as well as the examination of their self-regulation capabilities (i.e., self calming) and emotional control (i.e., managing upset, disappointment and anger).

### *2.3 Behavioural Adjustment*

The construct of behavioural adjustment refers to the actions or reactions of an individual, which have been learned or unlearned, and may be deliberate or habitual, in response to external and/or internal stimuli (Mosby, 2007). While children characterised by appropriate behavioural adjustment typically exhibit actions of a socially acceptable nature, those who are unable to display such actions may be considered to have poor behavioural adjustment. During childhood such behavioural problems are commonly grouped into two broadband domains of dysfunction;

externalising and internalising behaviour problems. Specifically, children exhibiting externalising behaviour problems are characterised by a lack of behavioural control (Hinshaw, 1992), which may be evident in behaviours such as conduct problems (i.e., lying, fighting, bullying and stealing) (Chronis, Lahey, Pelham, Williams, Baumann, Kipp et al., 2007), hyperactivity/inattention (i.e., difficulty staying on task, excessive motor activity, ignoring social rules, distractible) (Berk, 2001), as well as inhibitory control problems (i.e., the ability to resist or not act on impulse) (Achenbach & Edelbrock, 1978; Gioia, Espy, & Isquith, 2003; Sommerfelt, Troland, Ellersten, & Markestad, 1996). In contrast, children exhibiting internalising behaviour problems are characterised by extreme behavioural control (Hinshaw, 1992), with typically behaviours including emotional symptoms (i.e., fears, worries unhappiness) (Goodman, 1997), social withdrawal and elevated levels of anxiety (Achenbach & Edelbrock, 1978; Campbell, 2002).

Despite the characteristics of externalising and internalising behaviour problems being well defined, the developmental course of these difficulties is often much harder to determine. This is due in part to the changing behavioural demands and expectations that accompany children's early development (Keenan & Shaw, 1997). For example, during infancy behavioural problems may refer to inappropriate sleeping and feeding habits, high levels of negativity and resistance to external soothing efforts. However, during early childhood poor behavioural adjustment may refer to acts of non-compliance, aggression, temper tantrums and inhibitory control problems (Calkins, 2007; Kopp, 1982). Developmental periods of difficult behaviour or poor behavioural adjustment are often gradually outgrown as children benefit from advances in language, cognition, attention and emotional regulation (Calkins, 2007; Campbell, 2002; Ruff & Rothbart, 1996). Over time these developments generally facilitate children's capabilities to control impulsive tendencies, maintain attention and better

manage aggressive and non-compliant behaviours (Brownell & Kopp, 2007; Thompson & Goodvin, 2007). However, some children may continue to be characterised by poor behavioral adjustment in early childhood and are consequently placed at elevated risk of social compromise. For example, children with behavioural difficulties commonly exhibit greater levels of negativity, emotional dysregulation (Cole et al., 1996; Eisenberg et al., 1995; Eisenberg et al., 1997; Rubin et al., 1995) and peer problems (Henricsson & Rydell, 2006; Keane & Calkins, 2004).

A number of summary points arise concerning the relevance of behavioural adjustment to children's development of social competence. First, children developing externalising and internalising behavior problems during early childhood appear to have difficulty satisfying increasing behavioral demands. Second, these children may be at increased risk of compromise in other developmental domains, including emotional regulation and social difficulties. Third, it also seems likely that both externalising and internalising behaviors may be contributed to, at least in part, by concurrent difficulties in the regulation of emotion. Therefore, in this dissertation, behavioural adjustment is considered to be an integral factor in the development of social competence (see Figure 2.2) with assessment including measures of hyperactivity/inattention, conduct problems, inhibitory control problems and emotional symptoms.

#### *2.4 Interpersonal Social Behaviour*

In this dissertation, interpersonal social behaviour primarily refers to children's day-to-day social performance during play with their peers (see also Howes & Matheson, 1992; Isley, O'Neil, Clatfelter, & Parke, 1999), as the ability to participate in successfully peer relations is an important aspect of child development which requires the emergence and co-ordination of many interpersonal skills (Kupersmidt &

Coie, 1990). These include, for example, the ability to make and maintain friendships, and to foster popularity and social acceptance (Berndt & Burgy, 1996; Rose-Krasnor, 1997).

During infancy, interpersonal social behaviors usually emerge within the mutually regulated parent-infant relationship (Bronfenbrenner, 1979). Initial efforts by infants to engage in social interaction are likely aimed to facilitate caregiver motivation to provide comfort and to enhance the quality of the infant's early social relationships with other people (Siegler et al., 2003), as well as improving the infant's chances of survival (Berk, 2001). These rudimentary social efforts (i.e., crying) are gradually supplemented by more controllable social signals from the infant (Malatesta, Grigoryev, Lamb, Albin, & Culver, 1986). These include the emergence of social smiles at approximately 6-8 weeks of age (Sroufe, 1979) and the ability to recognise the value of an emotional expression at age 7-10 months (Berk, 2001). Further, during the latter part of the first year of life infants are able to use social referencing to actively seek emotional information from a trusted person during an uncertain situation (Campos & Stenberg, 1981). These interpersonal social skills are complimented by more advanced social behaviours as the infant continues to develop, such as the ability to preempt the consequences of events, to imitate complex social behaviors and to distinguish between and appropriately react to a range of emotional expressions (Baldwin & Moses, 1996). The infant is also increasingly able to participate in sustained periods of joint attention, being the ability to co-ordinate attention between objects and social partners (Moore & Dunham, 1995). Together, such developments across the first few years of life enable the infant to develop from a relatively passive to an increasingly active social partner (Bronfenbrenner, 1979; Brownell & Kopp, 2007).

During early childhood, the establishment and maintenance of social relationships with peers is further aided by developments in language, cognition, emotion and behaviour. For example, advances in communicative skill allow children to share information concerning their likes, dislikes and emotional states with peers (Dunn & Brown, 1991). Further, the emergence of self-conscious higher-order emotions, such as shame, embarrassment, guilt, envy and pride (Berk, 2001) facilitate children's understanding of societal expectations about what constitutes acceptable social behavior. For example, following the acquisition of self-conscious emotions, a child who removes a desired toy from a peer may feel guilty. Likewise, a child who does not follow the rules of a game may feel embarrassment as a consequence of negative peer reaction.

Children's social functioning is also likely to be influenced by concurrent developments in emotional regulation, behavioural adjustment and social cognition (Cassidy, 1994; Cicchetti et al., 1991; Eisenberg, Fabes, Bernzweig, Karbon, Poulin & Hanish, 1993). Emotional regulation abilities are associated with the quality of interpersonal social functioning among children (Eisenberg, Fabes, Guthrie, & Reiser, 2000) and are thought to be important for social interaction due to influences upon emotional expression, behaviour and the emotional tone of social interactions (Lopes, Salovey, Cote, & Beers, 2005). For example, an inappropriate outburst of anger may abruptly end a social interaction, while displays of pleasant emotions tend to elicit favourable responses from others (Argyle & Lu, 1990). In addition, poor peer relationships have also been linked to both externalising and internalising behavioural adjustment problems, including conduct problems, hyperactivity, inattention and passivity (Coolahan, Fantuzzo, Mendez, & McDermott, 2000). Moreover, both emotional dysregulation and behavioural adjustment difficulties have been found to have an adverse impact on future opportunities for social advancements through a

reduced exposure to social situations (Brownell & Kopp, 2007). Preschool-aged children may also experience advances in social cognition that enable a more accurate perception of social interaction and a better understanding of the perspective of social partners (Lamb, Bornstein, & Teti, 2002), which will likely contribute to more enhanced social relationships (Slomkowski & Dunn, 1996). For example, improvements in social cognition may facilitate children's awareness of other peoples' mood (Papalia, Olds, & Feldman, 2004) and will likely enhance children's efforts to gauge the feelings, beliefs and intentions of others (Slomkowski & Dunn, 1996).

While children clearly experience developments across a number of domains relevant to their interpersonal social functioning during early childhood, a fundamental requirement is that children successfully develop, apply and co-ordinate these on-going advances in ways that are conducive to successful interpersonal functioning. Children who are unable to successfully co-ordinate such advances are often at risk of a negative social trajectory that may have adverse implications for later academic, emotional, behavioural and social outcomes (Coolahan et al., 2000; Fantuzzo, Coolahan, Mendez, McDermott, & Sutton-Smith, 1998; Hampton & Fantuzzo, 2003). These difficulties are also likely to have ongoing negative impacts on later life course opportunities. In sum, children who are unable to develop and co-ordinate the emotional, behavioural, and social abilities that facilitate successful social interactions may be at risk of widespread developmental compromise and reduced access to social learning opportunities.

Within the current study the assessment of interpersonal social behaviour is based on the extent to which preschool-aged children exhibit behaviours conducive to successful social functioning (i.e., politeness, helping and sharing), as well as an examination of behaviours that may be detrimental to social relationships (i.e., disruption, demands and aggression, withdrawal and rejection).

## 2.5 Social Cognition

The construct of social cognition refers to those cognitive processes used to decode and encode the social world (Beer & Ochsner, 2006). One important cognitive process used to facilitate the perception of both others and self is that of theory of mind (ToM), being the ability to impute mental states to self and others (Premack & Woodruff, 1978). This system is viewed as a theory, first, because mental states are not observable, and, second, because this system can be used to make predictions about the behaviour of other organisms (Premack & Woodruff, 1978). As the ability to know about minds is required for all human interactions, theory of mind has attracted much research attention (Gopnik & Astington, 1988; Watson, Nixon, Wilson, & Capage, 1999; Wimmer & Perner, 1983; Woolfe, Want, & Siegal, 2002; Yirmiya, Erel, Shaked, & Solomonica-Levi, 1998), with false belief tasks commonly used to assess children's abilities to understand, explain, predict and manipulate the behaviour of others (for comprehensive reviews and collections, see Astington, Harris, & Olson, 1988; Lewis & Mitchell, 1994; Saxe & Baron-Cohen, 2007; Wellman, 1990).

Research efforts to trace the development of theory of mind in young children have lead to the identification of a typical pattern of gradual change. For example, at approximately 6 months of age infants begin to display systematic and age-related gains in the pre-linguistic skills of joint attention (Mundy & Gomes, 1998). This includes the development of capabilities such as following the direction of other's gaze, attempts to direct the attention of others using gestures such as pointing and showing (Carpenter, Nagell, & Tomasello, 1998), and alternating gaze between an object or shared event and a partner's face for the purposes of sharing (Clifford & Dissanayake, 2008). These abilities consolidate at approximately 18 months of age (Butterworth & Cochran, 1980), when children begin to exhibit symbolic activities that



involve behaviourally treating an object as symbolizing something that it is not (i.e., using a banana as a telephone) (Harris, 1991). These activities demonstrate a shift in the cognitive development of infants as they begin to think about alternatives to reality (Astington, 2001).

During early childhood, on-going developments in both cognition and language further facilitate social cognitive understanding. For example, by the age of three years, children become aware of differences between their own and other's mental states (Taylor, 1996), begin to use mental state terms (i.e., *think*, *remember*, *pretend*) (Wellman & Woolley, 1990), and start to talk about past events and things out of sight (Nelson, 1996). Preschool-aged children also undergo advances in cognitive flexibility (Hughes & Dunn, 1998; Jenkins & Astington, 1996) and aspects of executive functioning including working memory and planning capabilities which are also important to the development of social cognition, particularly theory of mind understanding (Carlson, Mandell, & Williams, 2004; Hughes & Ensor, 2007; Muller, Zelazo, & Imrisek, 2005; Sabbagh, Xu, Carlson, Moses, & Lee, 2006).

Additionally, children's social cognitive understanding is facilitated by exposure to positive social experiences, including maternal talk of feelings (Ruffman, Perner, & Parkin, 1999) and mental states (Ruffman, Slade, & Crowe, 2002), reflective disciplinary strategies (Ruffman et al., 1999), and social experience with siblings and peers (Hughes & Dunn, 1998; Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki, & Berridge, 1996; Perner & Ruffman, 1994; Ruffman, Perner, Naito, & Clements, 1998). Together, these developments contribute to children's understanding of false beliefs, desires and intentions, and their ability to make distinctions between appearance and reality and to be aware of people's sources of beliefs (Yirmiya et al., 1998). Children also begin to realise that people's actions are guided by their thoughts, beliefs and desires (Gopnik & Astington, 1988; Taylor, 1996; Wimmer & Perner, 1983). It has

been proposed that this general shift in children's concept of mind takes place at some point between the ages of three (Astington & Gopnik, 1991; Chandler, Fitz, & Hala, 1989; Flavell, Flavell, Green, & Moses, 1990; Lewis & Osbourne, 1990) to five years (Ruffman, Olson, Ash, & Keenan, 1993; Russell, Mauthner, Sharpe, & Tidwell, 1991).

In terms of the model of social competence developed for use in the current study, theory of mind is clearly important for social, emotional and behavioural functioning. For example, children with good theory of mind will be better able to attend to and interpret important social cues in order to anticipate the consequences of both their own and others decisions and behaviour (Crick & Dodge, 1996; Hoffman, 2000). Such children are better able to get along with their peers (Lalonde & Chandler, 1995), participate in extended periods of communication during play with peers (Slomkowski & Dunn, 1996), and experience greater popularity (Slaughter et al., 2002). In contrast, children with poor theory of mind are more likely to be characterized by inattention and poor inhibitory control (Hughes, Cutting, & Dunn, 2001), as well as elevated levels of aggression and peer rejection which are two of the most consistent behavioural precursors of adult psychopathology (Hartup, 1983). The development of theory of mind may be further hindered for children who are characterised by poor emotional regulation, behaviour problems and a lack of social skills due to associated reductions in social opportunities. While deficiencies in the ability to attribute mental states to oneself and others has been extensively examined in autistic populations (for a review see Baron-Cohen, 2001), given the importance of theory of mind for the development of social competence it will also be important to examine this emerging capability in other cohorts at risk of later emotional, behavioural and social difficulties.

## *2.6 Theoretical Approach*

The definition of social competence as a broad, overlapping construct sits comfortably with the theoretical framework of the current study. Adopting a developmental perspective, herein children's social competence is considered to be reflective of multiple pathways to development. This approach is aptly illustrated by Sroufe (1997) as a branching tree. This metaphor of a complex and constantly growing organism reflects the adopted theoretical approach to examining the diversity and multiplicity of children's social competence. Within the current study, the contributions of the active individual are examined within the dynamic processes and complex interplay of children's ever-changing contextual influences (Cummings, Davies, & Campbell, 2000).

From learning (i.e., Bandura, 1989) and contextual (i.e., Bronfenbrenner & Morris, 1998; Vygotsky, 1978) perspectives, it is important to consider children's development within the environments in which they interact. For example, it is through their shared activities with others that children are able to internalise their society's ways of thinking and behaviour (Vygotsky, 1978). Further, Bronfenbrenner's ecological perspective (1989) refers to 'multiple layers' of contextual influences on children's development (Bronfenbrenner, 1989). In terms of the development of social competence such 'layers', as discussed earlier, may comprise of the infant-parent relationship, social experience and role of siblings.

Finally, within a developmental model, children's social competence is viewed on a continuum from normal to abnormal. By applying a developmental perspective, issues concerning the antecedents, course, and outcome of children born very preterm can be examined, drawing upon relevant literature across multiple disciplines. No attempt is made to explain behaviour as the result of a single factor. Rather, within a developmental framework, children's social competence reflects a

succession of adaptations that have evolved over time with prior adaptations interacting with current circumstances in an on-going way (Sroufe, 1997). In sum, the conceptual model developed for use in the current study is grounded in developmental theory, and recognises the reciprocal and changing nature of children and their interactions with the surrounding environment.

### *Summary of the Development of Early Social Competence*

The inter-relatedness of emotional, behavioural, interpersonal and social cognitive development as depicted in my model (see Figure 2.2) has been clearly illustrated in the above reviews. From infancy to early childhood, children undergo enormous emotional, behavioural and social development. The successful negotiation and integration of these concurrent developments become increasingly important during the early childhood period when many children are first challenged with the task of independent social functioning with peers likely in relatively uncontrolled social environments. To be socially competent children need to be able to successfully orchestrate the appropriate expression and regulation of emotion, to exhibit situationally appropriate behavioural adjustment and social behaviour, as well as attend to and correctly interpret both the mental states of others and expected outcomes. Further, these efforts often take place while children attend to socially relevant information through peer interactions. From a developmental perspective, emotional, behavioural, interpersonal and social cognitive capabilities during early childhood are likely to continue to inform and shape children's development of social competence.

## Chapter 3

### Preterm Birth and Later Social Competence

As highlighted in Chapter 2, emotional regulation, behavioural adjustment, interpersonal social behaviour and social cognition represent important aspects of adaptive social functioning that are likely together and independently to play a significant role in shaping children's current and on-going social development. This chapter reviews studies that have examined the effects of preterm birth on children's subsequent emotional regulation, behavioural adjustment, interpersonal skills and social cognitive abilities. Given the limited number of studies examining the social competence of preschool-aged children born very preterm, those studies reviewed predominantly span the early (2-4 years) and middle (5-10 years) childhood periods. In addition, possible causal processes associated with outcomes in each domain and pertinent methodological issues are considered.

#### *3.1 Study Criteria*

A literature search was undertaken using the following databases: PsycINFO; PsycLIT; Dissertation Abstracts International; and PubMed. The following criteria were applied:

- i. Publication in the English language
- ii. Inclusion of a full term comparison sample
- iii. Preterm participants born during or following 1980
- iv. Examination of at least one of the key aspects of social competence included in the conceptual framework of this dissertation

### *3.2 Emotional Regulation in Children Born Preterm*

As outlined in Chapter 2, an important indicator of social competence is the ability to monitor and regulate emotional reactions and experiences. However, while several studies have examined these abilities in typically developing populations (for a review see Saarni, 1999) very few studies have examined emotional regulation amongst preterm populations (see Table 3.1 for an overview), particularly during the early childhood period. Rather, a review of the preterm literature shows that associations between prematurity and emotional regulation have been primarily examined during infancy. A range of measures have been used to examine emotional regulation in preterm infants, including: the Assessment of Preterm Infant's Behaviour (Als, Lester, Tronick, & Brazelton, 1982) which provides a measure of an infant's ability to modulate his or her response to controlled environmental input; the Neonatal Behavioural Assessment Scale (Brazelton, 1973) which assesses the newborn's ability to organise his or her physiological arousal, maintain motor control, regulate emotional states and capacity for attention; and the Behaviour Response Paradigm (Garcia-Coll, Emmons, Vohr, Ward, Brann, Shaul et al., 1988) which examines levels of infant emotionality. Further, the emotional regulation of preterm infants has been examined in relation to the quality of infant attachment relationships using the Ainsworth Strange Situation (Ainsworth, Blehar, Waters, & Wall, 1978), and behaviours such as social orientation, cooperativeness and fearfulness have been assessed using the Infant Behaviour Record of the Bayley Scales of Infant Development (Bayley, 1969).

The majority of these studies suggest that, compared to children born full term, preterm infants are at greater risk of emotional dysregulation, including poor state- and self-regulation abilities (Duffy, Als, & McAnulty, 1990; Mouradian, Als, & Coster, 2000). Preterm infants have also been found to exhibit more habituation problems, to make fewer self-soothing efforts (Paludetto, 1982), and to be more easily

distressed (Hsu & Jeng, 2008) and less able to maintain a relaxed emotional state (Feldman, 2006). For example, the largest of existing infancy studies compared healthy appropriate for gestational age (AGA) infants at age corrected 2 weeks across three gestational groups: early born preterm (GA 26-32 weeks,  $n=55$ ); middle born preterm (GA 33-37 weeks,  $n=43$ ); and full term comparison (GA 38-41 weeks,  $n=37$ ) infants (Duffy et al., 1990). Using the Assessment of Preterm Infant's Behaviour (Als, 1983; Als, Lester, Tronick & Brazelton, 1982) to quantify infants' abilities to modulate their emotional responses to controlled stimulation, examiners found that preterm infants (GA<37 weeks) were significantly more likely than full term infants to be characterised by stress and emotional disorganisation during the assessment, and had greater difficulty regaining a balanced and relaxed state after becoming distressed ( $p<.0001$ ).

There is also a tendency for infants born preterm to display more negative affect (Feldman, 2006; Malatesta et al., 1986). Specifically, a study by Feldman (2006) examined a regional, hospital-based middle class cohort consisting of two groups of preterm infants who were characterised by either high (BW<1,000 g & GA<30 weeks,  $n=17$ ) or low (BW 1,700-1,850 g & GA 34-35 weeks,  $n=25$ ) medical risk at age 3 months corrected, and a full term comparison sample ( $n=29$ ) (Feldman, 2006). Premature infants presenting with intraventricular hemorrhage (IVH Grades III or IV), perinatal asphyxia, metabolic, or genetic disease were excluded from the study. Using the Behaviour Response Paradigm, the results showed that compared to their full term peers both high and low medical risk infants born preterm had significantly poorer capacity to adjust to presented levels of arousal and the termination of environmental input, and required less environmental intrusion to elicit the display of negative affect ( $p<.01$ ). These findings tend to suggest that emotional dysregulation

amongst infants born preterm is not limited to those born at lower gestational ages and/or those preterm infants who are characterised by poor clinical presentation.

In contrast, some infancy studies have reported links between emotional dysregulation, lower gestational age (Duffy et al., 1990; Malatesta, Culver, Tesman, & Shepard, 1989; Mouradian et al., 2000) and greater postnatal illness (Duffy et al., 1990; Feldman, 2006; Greene, Fox, & Lewis, 1983; Malatesta et al., 1989). While it should be noted that a small number of studies suggest that these group differences become less evident by the end of the first year of life (DiPetro, Uhly, & Porges, 1992; Frodi & Thompson, 1985), several methodological limitations are apparent. These include the examination of small samples of unrepresentative, predominantly middle-class Caucasian infants, and the use of the original version of the Infant Behaviour Record which has since been updated and re-conceptualised. Clearly further research is required to clarify the nature and extent to which children born very preterm are at increased risk of emotional dysregulation, particularly beyond infancy, and the role of gestational age and clinical presentation, if indeed such differences persist.

### *3.2.1 Emotional Regulation in Early Childhood (2-4 years)*

To date, only two studies have examined the emotional regulation abilities of preschool-aged children born very preterm. Sajaniemi et al. (1998) examined a regional cohort of 80 very preterm (GA 23-34 weeks) toddlers at 24 months corrected age and a full term comparison sample of 80 children who were aged between 20-28 months (Sajaniemi, Salokorpi, & von Wendt, 1998). Children with congenital fetal abnormalities detected by ultrasound were excluded. Using the Infant Behaviour Record of the Bayley Scales of Infant Development (Bayley, 1969), ratings of negative emotionality were based on the impressions of a neuropsychologist following the administration of a general developmental assessment. Results showed that very



preterm and full term children were characterised by similar levels of co-operation, endurance and reactivity.

By contrast, a more recent longitudinal study by Clark et al. (2008) examined a regional cohort of 39 extremely preterm (GA<28 weeks), 56 very preterm (GA 28-33 weeks), and 103 full term (GA>37 weeks) children at age 2 and 4 years corrected using a composite measure of emotional regulation (Clark, Woodward, Horwood, & Moor 2008). Measures included coded observations of a semi-structured parent-child interaction, examiner report using the Infant Behaviour Record of the Bayley Scales of Infant Development, and the parent report Emotional Regulation Checklist (Shields & Cicchetti, 1997). Children with congenital abnormalities and those whose parents were non-English-speaking were excluded. Based on examiner report, they found that at age 2 years compared to their full term counterparts children born extremely preterm were significantly more likely to be characterised by poor emotional regulation, including, for example, more intense and prolonged displays of negative affect, and low levels of enthusiasm ( $p=.003$ ). Furthermore, at age 4 years children born extremely preterm continued to be characterised by emotional dysregulation with these difficulties now evident across both the research ( $p=.04$ ) and home ( $p=.002$ ) environments. In terms of possible causal processes implicated, Clark et al. (2008) found that compromised regulatory competence at age 4 years was significantly predicted by the presence of moderate to severe white matter abnormalities on term magnetic resonance imaging (MRI) and lower levels of parental sensitivity at age 2 years. Further, the receipt of maternal antenatal steroids played a protective role.

### *3.2.2 Emotional Regulation in Middle Childhood (5-10 years)*

Efforts to study the emotional regulation abilities of school-aged children born very preterm are also limited. Sommerfelt, et al. (1996) examined a regional low risk

sample of 144 very preterm (BW<2,000 g & GA<32 weeks uncorrected for extent of prematurity) and a randomly selected sample of 163 full term children at age 5 years (Sommerfelt et al., 1996). Children with cerebral palsy, blindness, deafness, multiple malformations and/or chromosomal aberrations were excluded. Maternal report based on the Yale Children's Inventory (Shaywitz, Schnell, & Towle, 1988), which is used to diagnose attention deficit/hyperactivity disorders, showed no between group differences concerning the extent to which very preterm and full term children were able to successfully adapt to changes in their environments and routines. Levels of mood fluctuations were also similar across both groups. Given the importance of emotional regulation for children's emerging behavioural and social development, along with the increasing recognition of emotional dysregulation as a potential indicator of later difficulties, spanning a range of behavioural adjustment problems and social difficulties (Calkins, 2007; Cole, Michel, & O'Donnell-Teti, 1994; Cole, Michel, & Teti, 1994; Cole et al., 1996; Denham & Burton, 2003; Eisenberg, 2002; Eisenberg et al., 1995; Eisenberg et al., 1997; Rubin et al., 1995; Shaw et al., 2000; Thompson & Goodvin, 2007), it will be important that limitations concerning the relative lack of research in this area are addressed. This will be particularly vital during the years prior to the transition to formal school education, when children born very preterm will encounter escalating emotional, behavioural, social and academic demands.

### *3.3 Behavioural Adjustment in Children Born Preterm*

As outlined in Chapter 2, behavioural adjustment is likely to be both an indicator of social competence and a significant contributing factor to development in this area. Behavioural difficulties in children born preterm were first noted over 50 years ago, with these children being described as restless, nervous, distractible and inattentive (Benton, 1940). Since then more extensive efforts have been made to

examine associations between preterm birth and later behavioural adjustment, including the examination of both externalising (i.e., hyperactivity and conduct problems) and internalising (i.e., social withdrawal and anxiety) behaviour. In general, existing studies suggest that prematurity may have negative consequences for behavioural adjustment as early as infancy (i.e., Als, 1988; Mouradian et al., 2000).

For example, a cross-sectional study by Mouradian et al. (2000) compared a healthy, regional sample of 13 preterm (GA=32 weeks, 4 days -35 weeks, 3 days), 13 close to term (GA 35 weeks, 4 days -38 weeks, 3 days) and 16 full term (GA 38 weeks, 4 days -41 weeks, 3 days) infants when they were 10-14 days old (Mouradian et al., 2000). All children in the study were required to meet extensive health criteria concerning: birth weight; length; head circumference appropriate for gestational age at birth (AGA); singleton; spontaneous vaginal delivery; vertex position; premature rupture of membranes less than 48 hours before delivery; 1- and 5-minute Apgar (Apgar, 1953) scores of 8 or better; and discharge home prior to 42 weeks after mother's last menstrual period. Further, children with congenital and chromosomal abnormalities, infections and/or central nervous system insult (intraventricular hemorrhage, cerebral cysts, periventricular leukomalacia and echogenicity on head ultrasound) were excluded. Using the Assessment of Preterm Infant's Behaviour, a linear relationship was found between gestational age and attention, as preterm infants showed significantly more difficulty achieving an alert and attentive state and were less able to orientate to external stimuli ( $p < .04$ ) than both close to term and full term infants. The following sections provide a brief overview of existing research examining the associations between preterm birth and behavioural adjustment during early and middle childhood (see Table 3.1 for an overview).

### *3.3.1 Behavioural Adjustment in Early Childhood (2-4 years)*

Research examining associations between prematurity and behavioural adjustment during early childhood is relatively limited. A prospective population-based cohort study by Delobel-Ayoub, et al. (2006) examined the behavioural adjustment of 1,228 very preterm (GA 22-32 weeks) and 447 full term (GA 39-40 weeks) children at age 3 years uncorrected using the parent Strengths and Difficulties Questionnaire (Goodman, 1997), which is a brief behavioural screening questionnaire (Delobel-Ayoub et al., 2006). Results showed that very preterm children were significantly more likely to be characterised by higher rates of both externalising and internalising behaviour problems. These included elevated rates of hyperactivity, conduct problems and emotional symptoms ( $p < .01$ ). Similarly, as part of a larger longitudinal study, Weisglas-Kuperus, et al. (1993) compared the behavioural adjustment of 114 VLBW (BW < 1,500 g and GA < 36 weeks) and 192 full term (GA 37-42 weeks) children without major congenital abnormalities. Using the parent Child Behaviour Checklist (Achenbach, 1991), they found that by the age of 3.5 years children born VLBW were already exhibiting elevated rates of both internalising ( $p > .0001$ ) and externalising ( $p = .03$ ) behaviour problems (Weisglas-Kuperus, Koot, Baerts, Fetter, & Sauer, 1993).

In addition, much of the existing research concerned with the behavioural adjustment of children born very preterm has focused on the extent to which these children may be at elevated risk of hyperactivity disorders and/or may be compromised in their capabilities to pay attention to a range of external stimuli. Sajaniemi et al. (1998), for example, in a study outlined earlier examined a regional cohort of 80 very preterm (GA 23-34 weeks) and a full term comparison sample of 80 children at approximately 24 months age (corrected) (Sajaniemi et al., 1998). Excluding children with congenital fetal abnormalities, the Infant Behaviour Record of the Bayley Scales

of Infant Development was used to study children's capacity for sustained attention to both an examiner and a number of tasks presented to children throughout a developmental assessment. Based on examiner report, compared to full term counterparts very preterm children were significantly less likely to remain attentive during testing ( $p < .002$ ). Interestingly, Sajanemi also found that inattention amongst preterm children was associated with a number of infant clinical characteristics, including: low birth weight ( $< 1,000$  g;  $p < .04$ ); periventricular leukomalacia and intraventricular hemorrhage ( $p < .006$ ); CP ( $p < .01$ ); longer stays in the Neonatal Intensive Care Unit ( $p < .05$ ); and a greater number of days on ventilation ( $p < .01$ ).

A further longitudinal follow-up study by Assel, et al. (2002) examined 180 preterm ( $GA \leq 36$  weeks &  $BW \leq 1,600$  g) and 112 full term ( $GA$  37-42 weeks) children from families of low-middle socio-economic status (Assel et al., 2002). Children diagnosed with significant sensory impairments, meningitis, encephalitis, symptomatic congenital syphilis and/or brain abnormalities, short bowel syndrome, or children HIV positive were excluded. Using only the social and attention subscales from the parent Child Behaviour Checklist, they found that compared to children born full term at age 4 years preterm children exhibited higher levels of impulsiveness and overactivity ( $p < .01$ ). Medium effect sizes ( $d = 0.43$ ) were found. However, the findings of this study must be interpreted with some caution. First, no age correction was made for the extent of prematurity, despite this being common practice for studies examining preterm infants and preschoolers (Als et al., 1988; Duffy et al., 1990; Feldman, 2006; Malatesta et al., 1989a; Paludetto, 1982). Therefore, it is not certain whether the group differences reported by Assel relate to prematurity or age differences between the groups. Second, the study samples examined were largely unrepresentative, consisting predominantly of African-American children from low socio-economic status environments.

By contrast, a longitudinal follow-up study by Hemgren (1999) examined three groups of children at age 3 years (corrected) who had received Neonatal Intensive Care and who were born very preterm (GA<32 weeks;  $n=68$ ), moderately preterm (GA 32-36 weeks;  $n=81$ ) or full term (GA 37-42 weeks;  $n=77$ ), and a fourth group of healthy comparison children born full term (GA 37-42 weeks;  $n=77$ ) (Hemgren & Persson, 1999). Using the Combined Assessment of Motor Performance and Behaviour (Hemgren & Persson, 1999), which provides a profile of children's developmental level of attention, results showed that throughout a 1.5 hour assessment of motor-perceptual development (Holle, Bonnelycke, Kemp, & Mortensen, 1998) all study children were similarly able to focus upon the examiner and to shift their attention to the associated tasks, and were also able to maintain their attention in the pursuit of task completion. Furthermore, approximately 50% of children in each group showed good attention across situations placing high (structured session of fine motor activities) or low (less structured gross motor tasks) demands on children's attentional capacity. While children with congenital malformations were excluded from the study, the authors recognise that the lack of inattention amongst the preterm children may be due to conceptual issues. More specifically, children were not considered to be inattentive if the particular task they were avoiding was considered to be too intellectually challenging for them. This highlights the conceptual difficulties that continue to be inherent in the examination of many psychological constructs.

Despite a range of methodological issues, including inconsistencies in preterm criteria and the use of age correction, together these studies suggest that higher rates of behavioural difficulties may be evident amongst children born very preterm as early as during the preschool years. In particular, preschool-aged children born very preterm may be most likely to exhibit attentional difficulties in the forms of more hyperactivity and greater impulsivity. Much less is known, however, about the behavioural and

attentional capabilities of children born very preterm across differing social environments, as existing studies during infancy have adopted a single informant design, based on reports of either parents or examiners. Therefore, the extent to which behavioural difficulties may be evident in other environments, such as children's preschools remains unknown. Further, little is known about the extent to which these difficulties may differ across settings in terms of their nature and prevalence. Given the extent to which externalising and internalising behaviours combined with attention difficulties would likely interfere with children's attainment of later educational expectations and goals, it will be imperative that further research attention is directed towards better understanding of the nature, extent and prevalence of behavioural difficulties during the early childhood years.

### *3.3.2 Behavioural Adjustment in Middle Childhood (5-10 years)*

By contrast to the limited number of preschool studies, evidence relating to the behavioural adjustment of very preterm children during middle childhood is extensive. While not all studies met the criteria for inclusion in this literature review, Bhutta's (2002) meta-analysis of studies spanning more than 20 years (1980-2001) examining the behavioural outcomes of school-aged children born preterm found that 81% of the 16 studies reviewed reported links between preterm birth and increased risks of externalising and internalising behaviour problems (Bhutta et al., 2002). Further, 67% of studies reviewed identified preterm school children as more inattentive than full term comparison children. However, whilst most studies in general provide clear support for behavioural adjustment problems amongst preterm children there are some inconsistencies. For instance, a cross-sectional study by Reijneveld, et al. (2006) compared 402 very preterm (GA<32 weeks & BW<1,500 g) children with two large national samples of children born full term (total  $n=6,007$ ; GA>37 weeks &

BW>3,000 g) at age 5 years (Reijneveld, de Kliene, Barr, Kollee, Verhaak, Verhulst et al., 2006). Based on the parent Child Behaviour Checklist, results showed that very preterm children were at greater risk than their full term counterparts of developing difficulties reflective of externalising and internalising behaviour problems, including inattention, delinquent and aggressive behaviour, withdrawal and somatic complaints. These group differences remained even after statistical control for a range of socio-environmental factors (i.e., maternal education, number of siblings and family composition). Moreover, children born very preterm were 1.48 times more likely than full term peers to exhibit externalising behaviours of clinical significance. However, levels of clinically significant internalising behaviour problems were similar for both groups. Within the very preterm sample, children with poor attention were characterised by elevated levels of artificial ventilation and steroid use around the time of birth, while children with greater internalising behaviour problems presented as newborns with moderate to severe intraventricular hemorrhage (grade 3-4).

While Reijneveld and colleagues acknowledge that the validity and reliability of these findings may have been strengthened by the use of a multi-informant approach, there is a large amount of literature to suggest that greater rates of inattention and hyperactivity in preterm children are commonly found on the basis of maternal report (Anderson & Doyle, 2003; Hille, den-Ouden, & Saigal, 2001; Hoff et al., 2004; Nadeau, Boivin, Tessier, Lefebvre, & Robaey, 2001; Sommerfelt et al., 1996; Szatmari, Saigal, Rosenbaum, Campbell, & King, 1990). For example, Hille et al. (2001) used the parent Child Behaviour Checklist to compare the behavioural adjustment of 408 ELBW (BW<1,000 g) and 2,852 full term children aged 8-10 years across four different countries (Netherlands, Germany, Canada and USA) (Hille et al., 2001). Results showed that rates of inattention were greatest amongst ELBW children



regardless of nationality, negating any potential influence of cultural differences. No group differences, however, were evident on measures of externalising behaviour.

While parent and teacher ratings have predominantly been used to examine the extent to which children born preterm are characterised by inattention and/or hyperactivity, a more recent study by Shum et al. (2008) compared the attentional capabilities of 45 very preterm ( $GA \leq 27$  weeks or  $BW \leq 1,000$  g) and 49 full term children at 7-9 years of age using parent and teacher versions of the ADHD Rating Scale-IV (DuPaul, Power, Anastopoulos, & Reid, 1998), as well as a range of psychological tests of attention (Shum, Neulinger, O'Callaghan, & Mohay, 2008). These included the Trail Making Test B (Reitan & Wolfson, 1993), the Stroop Colour Word Test (Golden, 1978), visual attention subtests of the NEPSY (Korkman, Kirk, & Kemp, 1997), and span subtests of the Weschler Intelligence Scale for Children – Third Edition (Weschler, 1991). Results showed that children born very preterm were characterised by poor attention span, were less able to maintain focused attention on psychological tasks, and were considered by their parents to be around 4 times more likely than their full term peers to be diagnosed as the ‘inattentive but not hyperactive’ subtype of ADHD. Furthermore, parent and teacher reports of children’s attentional capabilities were significantly predicted by performances on tests of attentional processes which highlighted the utility of examining parent and/or teacher report concerning children’s attentional capabilities, which may vary according to the demands of a particular environment.

Further, studies using multi-informant measures often reveal a range of behavioural difficulties amongst children born preterm. For example, as part of a longitudinal, follow-up study of a regional cohort of 61 EP/VLBW ( $GA < 29$  weeks &  $BW < 1,500$  g) and 44 full term children at age 7 years Nadeau et al. (2001) used the French version of the parent Child Behaviour Checklist, the Teacher Report Form

(Achenbach, 1991a) to assess behavioural problems, and a short version of the Revised Class Play (Masten, Morison, & Pelligrini, 1985) to assess peer ratings of behaviour at school (Nadeau et al., 2001). Results showed that children born EP/VLBW were more likely than full term children to be rated by their peers as being more sensitive and isolated ( $p<.01$ ), by their teachers as being less attentive in class ( $p<.01$ ), and by their parents as being more hyperactive ( $p<.01$ ). While peers of children born EP/VLBW noted more internalising behaviour problems and parents and teachers reported elevated rates of externalising behaviour, together these findings suggest that an array of behavioural adjustment difficulties are evident amongst school children born preterm and that these problems are detectable across a number of settings.

Likewise, a prospective follow-up study by Rickards et al. (1993) that compared 132 non-handicapped VLBW ( $BW<1,500$  g) and 60 full term children at age 8 years (corrected) using the Adelaide Teacher Report Scale (Glow, 1981) found that VLBW children were considered by their teachers to be less forthcoming and less assertive (Rickards, Kitchen, Doyle, Ford, Kelly & Callanan, 1993). This finding persisted after statistical adjustment for socio-demographic variables (i.e., maternal education and socio-economic status) and multiple births, and is also consistent with a number of studies reporting greater internalising behaviour problems amongst preterm children during middle childhood. These include reports of more somatic complaints (Anderson & Doyle, 2003; Sommerfelt et al., 1996), isolation (Nadeau et al., 2001), emotional symptoms (Bayless et al., 2008) and anxiety/depression problems (Sommerfelt et al., 1996), with associated effect sizes typically being in the small to medium range ( $d=0.25-0.45$ ). Despite links between preterm birth and elevated risks of a range of externalising and internalising behaviours, evidence to date suggests that preterm children are not at elevated risk of conduct behaviour problems during the

middle childhood period (Bayless et al., 2008; Nadeau et al., 2001; Szatmari et al., 1990).

Although the majority of available studies on behavioural outcomes in middle childhood tend to highlight increased risks of both or either internalising and externalising behavioural problems amongst preterm children, it should be noted that two studies suggest otherwise (Gonzalez & Robison, 2001; Portnoy, Callias, Wolke, & Gamus, 1988). Measures used in these studies included the parent Behavioural Screening Questionnaire (Richman & Graham, 1971), a structured parent interview, and parent and teacher ratings using the Social Skills Rating System (Gresham & Elliot, 1990). However, these studies also exhibit some methodological limitations. For example, the study by Portnoy et al. (1988) examined a small sample of extremely low birth weight ( $n=14$ ) and full term ( $n=14$ ) children at age 5 years using the Behavioural Screening Questionnaire primarily developed for use with children aged 3 years. Further, the study by Gonzalez and Robison (2001) also examined a small study sample ( $n=10$  in each case and control group) and undertook poor sample selection methods, with some participants identified through personal contacts. More generally, however, studies in this area suggest that school-aged children born preterm appear to be at an elevated risk for a range of behavioural adjustment difficulties, spanning externalising, internalising and attention problems, and that these difficulties may or may not be apparent across a number of contexts and situations. Therefore, the importance of incorporating multi-informant report is clearly highlighted as necessary for the enhanced understanding of the behavioural capabilities of children born preterm during the middle childhood period.

Although numerous studies have examined links between premature birth and behavioural adjustment in middle childhood, much less effort has been made to identify the infant clinical factors or socio-familial characteristics that may be

associated with compromised behavioural adjustment. Some of the infant clinical risk factors identified to date include a greater number of days spent on ventilation, the receipt of corticosteroids, male gender, moderate to severe intraventricular hemorrhage (Grade 3-4) (Reijneveld et al., 2006), low birth weight (Hack et al., 1994) and multiple births (Rickards et al., 1993). Socio-familial risk factors identified include family adversity (Nadeau et al., 2001), poor parental education and parental insensitivity (Hoff et al., 2004). However, those clinical and socio-familial risk factors identified are largely inconsistent across studies, suggesting that risk factors may vary according to the specific aspects of behavioural adjustment being examined (Levy-Shiff, Einat, Har-Even, & Mogilner, 1994). Clearly, further analysis is required to disentangle the risk factors specific to each area of behavioural adjustment.

### *3.4 Interpersonal Social Behaviour of Children Born Preterm*

As outlined in Chapter 2, the ability to successfully interact with peers is also recognised as a fundamental component of social competence. Despite this little attention has been given to the interpersonal social behaviour of children born very preterm. Further, existing studies have typically examined the extent to which a narrow range of social skills are exhibited by children born very preterm within their home environments. Whilst limited, there is some evidence to suggest that the early interpersonal experiences of very preterm children may differ somewhat to that of their full term counterparts. For example, a study by Crnic et al. (1983) compared the observed social behaviours of a regional cohort of 37 preterm (GA<37 weeks & BW<1,801 g) and 42 full term infants at ages 4, 8 and 12 months corrected (Crnic, Ragozin, Greenberg, Robinson, & Basham, 1983). Results showed that preterm infants made less eye contact and fewer vocalisation efforts, in addition to providing less clear social cues and being less socially responsive towards their parent during a

short videotaped episode consisting of both semi-structured and unstructured play. In a similar study, Beek et al. (1994) found that compared to full term and preterm ( $GA \geq 32$  weeks) infants, very preterm infants ( $GA < 32$  weeks) were characterised by delays in social development, including poorer orientation to mothers' faces and fewer speech-like vocalisations during parent-child interactions at ages 6, 12 and 18 weeks corrected (Beek, Hopkins, & Hoeksma, 1994). These findings clearly suggest that very preterm infants are at elevated risk of presenting as less responsive and more confusing social partners.

Findings also suggest that those very preterm infants born at earlier gestational ages and higher levels of clinical risk and/or illness may be most at risk of later impairments in social interactive behaviour. For example, Landry et al. (1997) found that at ages 6 and 12 months, LBW ( $GA < 36$  weeks &  $BW < 1,600$  g) infants at high medical risk made fewer social initiating efforts in the home-based contexts of 'toy play' and 'daily activities' than both full term infants and LBW infants at low medical risk (Landry, Denson, & Swank, 1997). Despite this evidence, however, very few efforts have been made to examine the interpersonal social behaviours of preterm children in later developmental periods (see Table 3.1 for an overview). The following sections provide a brief overview of the existing literature.

#### *3.4.1 Interpersonal Social Behaviour in Early Childhood (2-4 years)*

To date, only four studies have examined associations between very preterm birth and social relations during the early childhood period. Although three of these studies reported no group differences between preterm and full term children (Assel et al., 2002; Hemgren & Persson, 2002; Theunissen, Veen, Fekkes, Koopman, Zwinderman, Brugman et al., 2001), there are a number of methodological concerns inherent in each that warrant attention. Assel et al. (2002) for example, compared the

social behaviour of 180 preterm and 112 full term children at age 4 years using the parent Child Behaviour Checklist and an observational measure of children's social initiating efforts during parent-child interaction (Assel et al., 2002). While results showed that preterm and full term children were characterised by similar levels of social problems and social initiating, no age correction was made for the extent of prematurity and examinations were based on a largely unrepresentative (i.e., African-American children from low socio-economic environments) and healthy sample (i.e., children with significant sensory impairments, congenital abnormalities of the brain, and/or who were HIV positive were excluded). Similar findings have been reported elsewhere. For example, Hemgren et al. (2002) compared the social responsiveness of four groups of children (68 very preterm (GA<32 weeks); 81 moderately preterm (GA 32-36 weeks); 77 full term (37-42 weeks) requiring neonatal intensive care services; and 72 healthy full term) at age 3 years corrected (Hemgren & Persson, 2002). Using the Combined Assessment of Motor Performance and Behaviour, results showed comparable levels of social responsiveness across the four groups. Likewise, a study of four groups of children (65 very preterm (GA<32 weeks), 41 preterm (GA 32-36 weeks), 54 full term (GA 37-42 weeks) NICU and 50 full term) at ages 1.5-5 years by Theunissen et al. (2001) used the parent TNO-AZL Preschool Quality of Life (Feekes et al., 2000) questionnaire to assess health-related quality of life (Theunissen et al., 2001). Results showed that levels of social functioning were similar across the four groups. However, Theunissen et al. did find that specific infant clinical factors (i.e., PDA, hypotension), the number of past diagnoses and other disorders (i.e., hyperbilirubinemia) were predictive of impairments in social functioning. This suggests that within group variation exists with regards to the social functioning of children born preterm and that such variation may not be primarily attributed to gestational age.

While the majority of these studies suggest no group differences in the social functioning of preterm and full term children, a study by Chen et al. (2004) presents results to the contrary. Chen et al. compared the social functioning of a regional cohort of 238 VLBW (BW<1,500 g) and 91 full term comparison children at age 3 years corrected using the parent Chinese Child Developmental Inventory (Hsu, Su, & Shao, 1978) (Chen, Jeng, & Tsou, 2004). Results showed that VLBW children were characterised by more social difficulties, such as greater levels of social withdrawal, isolation and shyness ( $p<.001$ ) and were more likely to exhibit social problems which were functionally limiting (defined as  $>2SD$  below the control group mean;  $p<.001$ ). Medium effect sizes ( $d=0.44$ ) were found. Moreover, Chen et al. also found links between elevated rates of social difficulties and a number of clinical and social factors, including low gestational age ( $<30$  weeks), male gender, chronic lung disease, moderate to severe intraventricular hemorrhage and poor maternal education. This would suggest that during early childhood the social functioning of those born preterm is contributed to, at least in part, by both infant clinical factors and socio-familial characteristics.

#### *3.4.2 Interpersonal Social Behaviour in Middle Childhood (5-10 years)*

Studies undertaken in middle childhood generally yield more robust evidence of associations between prematurity and adverse social outcomes. For example, a study of 194 extremely preterm (GA<28 weeks or BW<1,000 g) and 72 full term children at age 5 years by Hoff et al. (2004) used a parent questionnaire to assess their children's overall social skills (Hoff et al., 2004). Questions concerned children's preference for adult company, dependence upon parents, passivity during play with others, difficulty being away from home, amount of play with same-aged peers, ability to understand and follow rules during play, and the extent to which they tend to destroy

the play situation. These items were then summed to provide a score reflective of children's social skills. Using a 75<sup>th</sup> percentile cut-point based on the distribution of control group scores, results showed that 31% of extremely preterm children had significantly poor social skills compared to 17% of full term children ( $p=.02$ ). Likewise, a study by Reijneveld et al. (2006) that used the parent Child Behaviour Checklist to compare the social capabilities of 402 VPT/VLBW (GA<32 weeks or BW<1,500 g) and 6,007 full term children at age 5 years found that VPT/VLBW children had more social problems ( $p<.001$ ) (Reijneveld et al., 2006). Medium effects sizes ( $d=0.48$ ) were found and group differences remained following statistical control for a range of background characteristics, including gender, family composition, number of siblings and maternal education.

While existing research suggests associations between prematurity and compromised social functioning are evident the home environment during the middle childhood years, efforts have also been made to examine the extent to which similar associations may be evident within the school environment. A prospective longitudinal study by Hack et al. (1994) compared 68 ELBW (BW<750 g), 65 preterm (BW 750-1,499 g) and 68 full term children using the Social Skills Rating Scale and found that at a mean age of 6.8 years ELBW children had significantly poorer social skills than both their preterm and full term counterparts (Hack et al., 1994). Together, the findings of Reijneveld, et al. (2006), Hoff, et al. (2004) and Hack, et al. (1994) suggest that preterm children are at an increased risk of social interaction difficulties during middle childhood, including being less cooperative, assertive, empathetic, and more irresponsible than their full term peers, as well as having fewer close friends and poor relationships with peers and siblings. Furthermore, those very preterm children at greater risk of social problems appear to be males (Reijneveld et al., 2006) who required artificial ventilation and/or the receipt of corticosteroids around the time of



birth, who have low IQ, and who have been raised in families characterised by poor parental education and reduced parental sensitivity (Hoff et al., 2004).

In contrast, a study by Sommerfelt et al. (1996) used the parent Personality Inventory of Childhood (Wirt, Lachar, Klinedinst, & Seat, 1984) to compare the social functioning of a population-based cohort of 144 healthy very preterm (GA<32 weeks) and a random sample of 163 full term children at age 5 years (Sommerfelt et al., 1996). Results showed that preterm and full term children were characterised by similar levels of social skill. Likewise, a study by Bayless et al. (2008) comparing 69 very preterm (GA<32 weeks) and 70 full term children using the parent Strength and Difficulties Questionnaire (SDQ) found that all study children were characterised by similar levels of peer relationship problems at age 6 to 12 years (Bayless et al., 2008). However, as acknowledged by Sommerfelt et al. (1996) the examination of social skills across a broad range of contexts (i.e., home and school) may have been more revealing.

### *3.5 Social Cognition of Children Born Preterm*

As outlined in Chapter 2, the extent to which a child is able to correctly infer other peoples' mental states may also be an important indicator and contributor to their level of social competence. However, despite the fact that preterm infants are recognised as challenging social partners (Goldberg & DiVitto, 2002) no studies have examined very preterm children's later social cognitive abilities in the form of theory of mind. However, there have been some efforts to examine the extent to which preterm infants are able to successfully participate in social interactions requiring joint attention, an ability that plays a significant role in social learning and social cognitive development (Bakeman & Adamson, 1984; Tomasello, Kruger, & Ratner, 1993). Briefly defined, joint attention is the ability to coordinate attention with another person to an object of shared interest (Smith & Ulvund, 2003). Assessments of maternal and

infant joint attention behaviours amongst preterm infants are typically based on the examination of coded videotaped observations of mother-infant interaction (Garner, Landry, & Richardson, 1991; Landry, 1986), or on the results of the examiner administrated Early Social Communication Scales (Mundy, Delgado, Block, Venezia, Hogan & Seibert, 2003) which are used to assess an infant's abilities to establish a common framework with an interactive partner (Erik & Smith, 1996; Olafsen, Ronning, Kaaresen, Ulvund, Handegard & Dahl, 2006).

While studies are limited, there is evidence to suggest that preterm infants may be at elevated risk of joint attention difficulties. These include a greater need for intermittent 'breaks' from social interaction at age 6 months (Landry, 1986), difficulty responding to joint attention efforts at age 12 months (Olafsen et al., 2006), deficits in efforts to direct the attention of other people and problems demonstrating coordinated eye gaze behaviours across the first 2 years of life (Garner et al., 1991), as well as lower levels of joint attention initiation at age 2 years (Groote, 2006). For example, a study by Groote (2006) compared a regional cohort of 25 high risk preterm (BW<1,250 g or GA<30 weeks) and 19 full term children at age 2 years uncorrected using the Autism Diagnostic Observation Schedule – Generic (Lord, Rutter, DiLavore, & Risi, 1999) and found that preterm children were less likely to give and show objects, spontaneously initiate joint attention and/or point when interacting with a experimenter (Groote, 2006).

These findings are of concern as early difficulties in joint attention amongst very preterm children have been identified as a predictor of later cognitive (Smith & Ulvund, 2003; Ulvund & Smith, 1996) and language (Ulvund & Smith, 1996) difficulties. While less is currently known about the longer-term social consequences of early difficulties in joint attention for very preterm children, in other at-risk populations such challenges have been associated with more disruptive and negative

play behaviours (Sheinkopf, Mundy, Claussen, & Willoughby, 2004). Given the evidence suggesting that preterm infants may experience some difficulties in joint attention, combined with the significance of this early ability as a precursor to social cognitive understanding, there is a clear need to examine the developing social cognition of preschoolers born very preterm. Such research efforts may contribute to a better understanding of the range of social developmental processes that may be compromised by very preterm birth, and may also offer further avenues for effective intervention aimed at optimising the social abilities of children born very preterm.

### *Summary of Social Competence Literature*

While limited in some respects, existing literature examining the emotional regulation, behavioural adjustment, interpersonal social behaviour and social cognitive outcomes of children born preterm offer several key points. First, there is evidence to suggest that being born very preterm may be associated with a range of social competence difficulties as early as infancy. These include poor self-regulatory capabilities, greater negative affect, inattention and orientation problems as well as developmental delays in social interactive behaviours important for early social communication. There has also been some evidence to suggest that social competence difficulties are evident during early childhood, including elevated rates of inattention as well as both externalising and internalising behaviour problems. However, few studies have undertaken a comprehensive evaluation of attentional and behavioural difficulties. In contrast, little evidence exists to date to suggest that associations between very preterm birth and emotional regulation problems and/or interpersonal social behaviour difficulties are evident during the early childhood period. Further, no examinations have been made concerning the social cognition of very preterm children during this developmental period.

However, research does suggest that school-aged children born very preterm may be at elevated risk of a range of social competence problems. These include elevated levels of social rejection and more peer relationship problems, as well externalising and internalising behaviour problems, particularly inattention and hyperactivity. This highlights the importance of identifying children with social competence deficits prior to school age. Better identification of preterm children at risk of compromised social development during the early childhood years may help to minimise the possible negative consequences for emotional, behavioural, social and academic functioning at school.

More specifically, evidence of elevated rates of behavioural adjustment problems and interpersonal social difficulties during middle childhood amongst children born very preterm is of concern for two main reasons. First, these difficulties often coincide with entry to formal schooling and must therefore be considered with regards to school academic achievement and behavioural adjustment. Second, school entry is a time when at risk children may ‘enter’ a negative social developmental trajectory whereby those children lacking social competence may avoid, or be excluded from, subsequent social interactions. In turn, children characterised by poor social competence will likely have fewer opportunities to observe, develop and implement more successful social efforts with peers, which may contribute to increasing social isolation throughout childhood and later developmental periods.

Despite the methodological shortcomings evident in the preceding literature review, current research suggests that children born preterm may not cope as well as full term children with independent emotional regulation, behavioural adjustment and interpersonal social functioning particularly during middle childhood. Moreover, these difficulties appear to be robust to statistical control for the selection effects of socio-economic status. Further, as outlined previously in this chapter, there is some evidence

to suggest links between adverse social competence outcomes and infant clinical and/or socio-environmental factors in preterm samples. Clinical risk factors identified to date include low gestational age, low birth weight, male gender, patent ductus arteriosus, neurological insult and compromised respiratory functioning. Identified socio-familial risk factors include poor maternal education, low SES, maternal stress and parental insensitivity. However, as highlighted in the literature reviews, those infant clinical and socio-familial risk factors associated with poor social competence among children born preterm have been largely inconsistent. This suggests that risk factors may vary depending on the particular aspect of social competence being examined. Further efforts to identify the perhaps differential risk factors associated with a broad range of social competencies are therefore required to facilitate greater clarity in this area. Clearly, there is more to be understood about the social competence of children born preterm particularly during the early childhood period.

### *3.6 Limitations in Studies of the Social Competence of Children Born Preterm*

Several methodology limitations, primarily involving sampling, that were highlighted in the preceding literature review have limited the interpretation of existing studies. For example, many studies have recruited preterm participants solely on the basis of birth weight criteria (Brown, Howard, Turnbull, & Lemanek, 2003; Chen et al., 2004; Grunau et al., 2004; Indredavik, Vik, Heyerdahl, Kulseng, & Brubakk, 2005; Rickards et al., 2001; Taylor, Klein, Minich, & Hack, 2000b). As a result, these studies may include older preterm infants who were born small-for-gestational-age (SGA). Further, almost half of all the studies reviewed were based on the examination of small study samples ( $n < 45$ ). Consequently, the findings of these studies may have poor reliability and validity, as well as compromised generalisability to the larger preterm population. Recruitment concerns are also evident, with many studies

examining the social competence of school-aged preterm children using classroom control children for the purposes of comparison (Botting, Powls, & Cooke, 1997; Brown et al., 2003; Foulder-Hughes & Cooke, 2003; Gardner et al., 2004; Hack et al., 1994; Taylor et al., 2000b). It is preferable to recruit comparison children either at birth or early on in their development to allow for the better examination of a child's development over time (Lukeman & Melvin, 1993). Sample attrition is also of concern across several studies (Elgen, Sommerfelt, & Markestad, 2002; Foulder-Hughes & Cooke, 2003; Weisglas-Kuperus et al., 1993), particularly given that those children lost to follow-up are more likely to come from lower socio-economic groups who generally have poorer outcomes (Aylward, Hatcher, & Stripp, 1985).

It is also important to note that research examining the developmental outcomes of those born preterm is especially vulnerable to cohort effects, due to on-going advances in the medical care of the preterm newborn. However, much of the literature presently available examines preterm infants or children born prior to the medical advances of the 'post-surfactant' era. These more recent progressions including the introduction of surfactant, the increased provision of ventilation and the use of corticosteroids (Ferrara, Hoestra, & Couser, 1994) are expected to improve long-term outcomes for preterm infants (Foulder-Hughes & Cooke, 2003; Hack & Fanaroff, 1999). Therefore, further studies are required to examine the developmental outcomes of children born very preterm who have likely benefitted from these medical advances.

Such methodological shortcomings inherent in existing studies assessing links between prematurity and various aspects of social competence may have serious implications for the detection of less severe, but nonetheless important adverse developmental outcomes. Further research utilising more robust methodology is required to strengthen existing knowledge of the early social capabilities of children born very preterm, as well as to provide a more solid foundation for future research.

These research efforts will also be important for the on-going development and provision of early interventions aimed at facilitating optimal outcomes for very preterm children identified as being at increased risk of likely longer-term social compromise. This dissertation attempts to make such a contribution.

*Table 3.1 Prior Studies Examining the Social Competence of Children Born Preterm in Early and Middle Childhood*

Dev. Period	Author/s	Sample	Age Seen	Study Design	Domain	Measures	FINDINGS	Effect Sizes (D)	Strengths & Challenges
Early Childhood (2-4 years)	Theunissen, et al. (2001) NETHERLANDS	VPT $n=65$ GA <32 wks  PT $n=41$ GA 32-36 wks  Term NICU $n=54$ GA $\leq 37$ wks  Term $n=50$	1-4 years	Longitudinal	Interpersonal social behaviour	TNO-APL Preschool Quality of Life Questionnaire (TAPQOL) - Social functioning	Parent report revealed no group differences on measures of social functioning with other children. Amongst children born preterm, poorer social functioning was associated with circulation problems (i.e., PDA) and other disorders (i.e., hyperbilirubinemia) ( $p \leq .05$ ).  <b>Conclusion:</b> All study children exhibited similar levels of social functioning, regardless of gestational age.	NS	- Sole informant
	Sajaniemi, et al. (1998) FINLAND	PT $n=80$ GA 23-34 wks  Term $n=80$	24 months +/- 2 weeks corrected	Case-Control	Emotional regulation  Behavioural adjustment	Infant Behaviour Record (IBR)	Compared to full term counterparts, examiner report showed preterm children were less attentive ( $p < .002$ ). Amongst preterm infants, inattention was associated with low birth weight (BW <1,000g, $p < .04$ ), low IQ scores ( $p < .0001$ ), PVL, IVH ( $p < .006$ ), CP ( $p < .01$ ), more NICU days ( $p < .003$ ) and greater days on ventilation ( $p < .01$ ). No group differences were found on measures of negative emotional tone.  <b>Conclusion:</b> Evidence was found of links between very preterm birth and increased risk of inattention. While group differences were not found concerning the display of negative affect, the study authors speculate that central nervous system dysfunction may place some very preterm infants at risk of compromised emotional regulation capabilities. Further, very preterm children	NS  Required figures not provided	+ PT sample age corrected - No GA criteria detailed for full term sample



*Table 3.1 (continued) Prior Studies Examining the Social Competence of Children Born Preterm in Early and Middle Childhood*

Dev. Period	Author/s	Sample	Age Seen	Study Design	Domain	Measures	FINDINGS	Effect Sizes (D)	Strengths & Challenges
Early Childhood (2-4 years) continued	Hemgren, et al. (2002) SWEDEN	VPT NICU <i>n</i> =68 GA<32 weeks  PT NICU <i>n</i> =81 GA 32-36 wks  Term NICU <i>n</i> =77 GA 37-42 wks [excluded children with congenital malformations]  Term <i>n</i> =77	3 years corrected	Longitudinal	Behavioural adjustment  Interpersonal social behaviour	Combined Assessment of Motor Performance and Behaviour (CAMP)	Results showed no group differences on measures of attention or social behaviour during a motor perceptual assessment. The majority of all children showed adequate social behaviour.  <u>Conclusion:</u> While the attention ability of children varied, no significant group differences were found.	NS	+ PT samples age corrected + Samples matched for birth order and sex - Sole informant
	Delobel-Ayoub, et al. (2006) FRANCE	VPT <i>n</i> =1228 GA 22-32 wks  Term <i>n</i> =447 GA 39-40 wks	3 years	Longitudinal	Behavioural adjustment	Strengths and Difficulties Questionnaire (SDQ)	Compared to full term counterparts, parent report showed that preterm children had more externalising and internalising behaviour problems ( $p<.01$ ). Group differences were robust to statistical control for neonatal complications, socio-demographic characteristics and neuro-developmental outcome.  <u>Conclusion:</u> Children born very preterm are at elevated risk of behavioural adjustment difficulties during early childhood.	OR 2.1 OR 1.7	+ Population-based cohort + High follow-up rates (96% preterm; 84% term) - Age of PT children uncorrected - Unmatched control sample - Postal questionnaire

Table 3.1 (continued) Prior Studies Examining the Social Competence of Children Born Preterm in Early and Middle Childhood

Dev. Period	Author/s	Sample	Age Seen	Study Design	Domain	Measures	FINDINGS	Effect Sizes (D)	Strengths & Challenges
Early Childhood (2-4 years) continued	Chen, et al. (2004) TAIWAN	VLBW $n=238$ BW<1,500 g  Term $n=91$ GA 38-42 wks	3 years corrected	Longitudinal	Interpersonal social behaviour	Chinese Child Developmental Inventory (CCDI)	Compared to full term counterparts, parent report showed VLBW infants had poorer personal-social development ( $p=.0005$ ) and were more likely to show functional social limitations (18% vs. 5%). Personal-social limitations were associated with lower gestational age (<30 weeks), chronic lung disease, male gender and poor maternal education.  <u>Conclusion:</u> VLBW infants are at greater risk of functional social morbidity at age 3 years. Poorer social outcome was associated with both clinical and socio-demographic factors.	0.44	- Sole informant - High attrition rates (26% VLBW; 12% FT)
	Weisglas-Kuperus, et al. (1993) NETHERLANDS	VLBW $n=114$ BW<1,500 g & GA<36 wks [excluded children with major congenital anomalies]  Term $n=192$	3.5 years	Longitudinal	Behavioural adjustment	Child Behaviour Checklist (CBCL)	Compared to full term counterparts, parent report showed VLBW children had more internalising ( $p<.0001$ ) and externalising ( $p=.03$ ) behaviour. These problems were associated with adverse home environment.  <u>Conclusion:</u> Associations between prematurity and internalising behaviour problems may arise from parental reaction to preterm birth, while inattention may be indirectly linked to brain abnormalities and home environment via cognitive impairments.	Required figures not provided	- PT sample uncorrected for extent of prematurity - No criteria details for term group - No recruitment details

*Table 3.1 (continued) Prior Studies Examining the Social Competence of Children Born Preterm in Early and Middle Childhood*

Dev. Period	Author/s	Sample	Age Seen	Study Design	Domain	Measures	FINDINGS	Effect Sizes (D)	Strengths & Challenges
Early Childhood (2-4 years) continued	Assel, et al. (2002) USA	PT $n=180$ BW $\leq 1,600$ g & GA $\leq 36$ wks [excluded children with major congenital abnormalities, significant illness and/or brain abnormalities]  Term $n=112$ GA 37-42 wks	4 years	Longitudinal	Behavioural adjustment  Interpersonal social behaviour	Child Behaviour Checklist (CBCL)  Observed social initiating skills Social problems	Compared to full term children, parent report showed preterm children were less attentive ( $p<.01$ ). These problems were associated with maternal emotional stress ( $p<.01$ ) and child rearing history ( $p<.01$ ). Group differences were not found concerning observed levels of social initiation or parent-reported social problems.  <u>Conclusion:</u> Premature birth is associated with increased risk of inattention and it is important to consider both clinical and environmental risk factors.	0.43	+ Observer blind to child status + Large samples + Demographically matched samples - Predominantly African-American and low SES samples - Age of PT sample uncorrected for extent of prematurity
	Clark, et al. (2008) NZ	EPT $n=39$ (GA $<28$ weeks)  VPT $n=56$ (GA 28-33 weeks)  Term $n=103$ (GA $>37$ weeks) [excluded children with congenital abnormalities and those with non-English-speaking parents]	2 & 4 years corrected	Longitudinal	Emotional regulation	Observed negative affect, positive affect and task transition  Behaviour Rating Scale  Emotion Regulation Checklist (ERC)	At age 2 years, based on examiner report children born extremely preterm had poorer emotional regulation than both very preterm and full term counterparts ( $p=.003$ ). At age 4 years, children born extremely preterm continued to demonstrate poorer emotional regulation based on both examiner ( $p=.04$ ) and parent ( $p=.002$ ) report.  <u>Conclusion:</u> Longer-term follow up will be required to better understand the relevance of early emotional regulation difficulties.	2 years 0.22-0.60  4 years 0.12-0.75	+ Longitudinal analysis + Sample age corrected for extent of prematurity + Matched samples + Multi-informant design + High recruitment and retention rates

Table 3.1 (continued) Prior Studies Examining the Social Competence of Children Born Preterm in Early and Middle Childhood

Dev. Period	Author/s	Sample	Age Seen	Study Design	Domain	Measures	FINDINGS	Effect Sizes (D)	Strengths & Challenges
Middle Childhood (5-10 years) continued	Sommerfelt, et al. (1996)	PT $n=144$ BW<2,000 g  Term $n=163$ BW>3,000 g & GA>37 wks [excluded children with major neuro-developmental impairment]	5 years	Case-Control	Emotional regulation  Behavioural adjustment  Interpersonal social behaviour	Yale Children's Inventory (YCI)  Personality Inventory of Childhood (PIC)  Examiner's Rating Scale (ERS)	Compared to full term counterparts, parent report showed that following control for parental factors and child IQ preterm children had more somatic problems, anxiety, impulsivity and distractibility ( $p<.10$ ) and social problems at age 5 years. Examiner report also indicated preterm children were more distractible ( $p=.08$ ). Group differences were not found on measures of attention, hyperactivity, withdrawal or clinically significant problems (>95 <sup>th</sup> percentile: 2% per group).  <u>Conclusion:</u> Preterm children tended to be characterised by more internalising symptoms rather than hyperactivity problems.	OR 1.8-3.9	+Efforts made to keep examiners blind to child status -Sole informant on PIC and YCI measures
	Szatmari, et al. (1990) CANADA	ELBW $n=82$ BW 500-1,000 g  Term $n=208$ BW>1,500 g	5 years	Longitudinal	Behavioural adjustment	Child Behaviour Checklist (CBCL)  Survey Diagnostic Instrument (SDI)	Compared to full term children, parent report showed ELBW children had more ADDH ( $p=.03$ ). Teacher reports were similar, although not statistically significant. Both groups displayed similar levels of conduct problems and emotional disorder.  <u>Conclusion:</u> The increased risk for psychiatric disorder amongst low birth weight children appears to be specific to ADDH. These problems may arise from a substrate of neurological impairment.	Required figures not provided	+ Multi-informant design - Age of PT samples uncorrected for extent of prematurity - Unmatched control sample
	Portnoy, et al. (1988) UK	ELBW $n=14$ BW<1,000 g [excluded children with significant handicap at age 2 years]  Term $n=14$ BW>2,500 g & GA 38-42 wks	5 years	Longitudinal	Behavioural adjustment	Behavioural Screening Questionnaire (BSQ)	Parent report revealed no group differences on measures of behavioural adjustment problems, including those of clinical significance.  <u>Conclusion:</u> Extremely low birth weight was not associated with greater behavioural compromise.	NS	+ Highly matched control group + Regional sample - Age of PT sample uncorrected for extent of prematurity - BSQ measure age inappropriate - Individual measures of 'behaviour' unspecified - Small sample size

Table 3.1 (continued) Prior Studies Examining the Social Competence of Children Born Preterm in Early and Middle Childhood

Dev. Period	Author/s	Sample	Age Seen	Study Design	Domain	Measures	FINDINGS	Effect Sizes (D)	Strengths & Challenges
Middle Childhood (5-10 years) continued	Hoff, et al. (2004) DENMARK	EPT $n=194$ BW<1,000 g or GA<28 wks [Neuro-sensory disability $n=15$ ; Non-disabled normal IQ $n=94$ ; Non-disabled sub-normal IQ $n=85$ ]  Term $n=72$	5 years	Longitudinal	Behavioural adjustment   Interpersonal social behaviour	Connors Abbreviated Symptom Questionnaire for Parents  7 outward reacting questions  5 anxious/withdrawn questions  6 social skills questions	Compared to full term counterparts, parent report showed preterm children were more outward reacting/hyperactive ( $p=.005$ ) and had more social problems ( $p<.001$ ). No group differences were found on measures of anxious/withdrawn behaviour. Associations were found between Inattention/hyperactivity and subnormal IQ ( $p<.004$ ), externalising behaviour, poor social skills and poor parental education and reduced maternal sensitivity.  <u>Conclusion:</u> A higher proportion of preterm children exhibit inattentive/hyperactive behaviour and social difficulties.	NS  Required figures not provided	+ Samples matched for age, gender and parental education - Investigators not blind to birth weight status
	Reijneveld, et al. (2006) NETHERLANDS	PT $n=402$ BW<1,500 g or GA<32 wks  Term $n=6007$	5 years	Case-Control	Behavioural adjustment  Interpersonal social behaviour	Child Behaviour Checklist (CBCL)	Compared to full term counterparts, parent report showed preterm children had more externalising and internalising behaviour ( $p<.001$ ), including more clinically significant externalising behaviour problems (PT 11.9% vs. FT 8.4%), and more social problems ( $p<.001$ ). Group differences were robust to statistical control for background factors. Preterm children were 2.6 times more likely to exhibit clinically significant social problems. Inattention and social problems were associated with artificial ventilation ( $p<.03$ ), steroid use ( $p<.02$ ) and male gender ( $p<.05$ ). Internalising behaviour problems were associated with grade 3-4 IVH ( $p=.02$ ). Withdrawn behaviours were associated with female gender ( $p<.05$ ).  <u>Conclusion:</u> Social, emotional and behavioural problems occur more frequently in children born prematurely at age 5 years. Severe neonatal problems are associated with poorer behavioural adjustment and compromised social functioning.	0.22-0.48	+ Large national samples

Table 3.1 (continued) Prior Studies Examining the Social Competence of Children Born Preterm in Early and Middle Childhood

Dev. Period	Author/s	Sample	Age Seen	Study Design	Domain	Measures	FINDINGS	Effect Sizes (D)	Strengths & Challenges
Middle Childhood (5-10 years) continued	Gonzalez & Robison (2001) USA	PT $n=10$ BW 1,000-2,500 g & GA 25-37 wks [excluded children with severe developmental difficulties]  Term $n=10$ BW >2,500g & GA 38-40 wks	6-8.9 years	Case-Control	Behavioural adjustment	Social Skills Rating System (SSRS)	Group differences were not found on any measures of behavioural adjustment based on both parent and teacher report.  <u>Conclusion:</u> While no group differences were found, the authors note a need for additional research using larger samples.	NS	+ Samples matched for age, race and gender - Small samples, with some identified via personal contacts - Wide age range for timing of assessment - PT group includes a set of triplets
	Nadeau, et al. (2001) CANADA	EPT/VLBW $n=61$ BW <1,500 g & GA <29 wks  Term $n=44$ BW >2,500 g & GA >37 wks	7 years	Longitudinal	Behavioural adjustment	Child Behaviour Checklist (CBCL)  Teacher Report Form (TRF)  Revised Class Play (RCP)	Compared to full term counterparts, EPT/VLBW children were rated by peers as more sensitive/isolated ( $p < .01$ ), by teachers as less attentive ( $p < .01$ ) and by parents as more hyperactive ( $p < .01$ ). Group differences were not found on measures of aggression. Risk factors associated with behavioural adjustment varied according to outcome behaviour.  <u>Conclusion:</u> Although some EPT/VLBW children were at greater risk of behaviour problems at school age, many of these children were found to be developing normally.	Required figures not provided	+ Samples matched for age, gender and SES + Multi-informant design
	Foulder-Hughes, et al. (2003) UK	PT $n=280$ GA <32 wks  Term $n=210$	7-8 years	Case-Control	Behavioural adjustment	Connors' Teacher Rating Scale for ADHD  Movement Assessment Battery for Children (MABC)	Compared to full term children, teachers rated preterm children as more overactive ( $p < .001$ ), tense ( $p = .002$ ), impulsive, distractible, disorganised ( $p < .001$ ) and inattentive ( $p = .01$ ). In fact, 8.9% of preterm children met the criteria for ADHD versus 2.1% of term children ( $p = .01$ ).  <u>Conclusion:</u> Behavioural difficulties were more prevalent amongst the preterm group. These difficulties were associated with adverse motor and cognitive development.	Required figures not provided	+ Large study sample + Regional cohort - Classmate controls - Research assistants not blind to birth status - No GA criteria detailed for full term sample - High attrition rate in the preterm sample (27%)

Table 3.1 (continued) Prior Studies Examining the Social Competence of Children Born Preterm in Early and Middle Childhood

Dev. Period	Author/s	Sample	Age Seen	Study Design	Domain	Measures	FINDINGS	Effect Sizes (D)	Strengths & Challenges
Middle Childhood (5-10 years) continued	Hack, et al. (1994) USA	ELBW $n=68$ BW<750 g  PT $n=65$ BW 750-1,499 g  Term $n=68$	6.7 $\pm$ 0.9 years  6.9 $\pm$ 0.9 years  7.0 $\pm$ 0.9 years	Longitudinal	Behavioural adjustment  Interpersonal social behaviour	Child Behaviour Checklist (CBCL)  Teacher Report Form (TRF)	Compared to full term counterparts, ELBW children were more inattentive, had higher total problem scores, and displayed more social problems at school. Difficulties were associated with lower birth weight but not social disadvantage.  <b>Conclusion:</b> ELBW infants (<750 g) represent a distinct subgroup of children predisposed to excessive pulmonary and central nervous system injury.	OR 2.1-2.2	+ Regional cohort + Samples matched for ethnicity and gender - Case criteria based solely on birth weight - Classroom controls randomly selected
	Shum, et al. (2008) AUSTRALIA	VPT $n=45$ BW $\leq$ 1,000 g or GA $\leq$ 27 weeks  Term $n=49$ BW $\geq$ 2,500 g or GA $\geq$ 37 weeks  [excluded children with serious neurological problems & all children needed to be in mainstream school with GQ>85 at age 4 years)	7-9 years	Case-Control	Behavioural adjustment	Digit forward subtest of the Weschler Intelligence Scale for Children – III  Visual attention subtest of the NEPSY  Trail Making Test part B  Stroop Colour Word Test  ADHD Rating Scale-IV	Adjusting for age as a covariate, results showed very preterm children were characterised by poor attention span, were less able to maintain focused attention ( $p\leq.01$ ), and were approximately 4 x more likely than full term children to be at risk for an inattentive ADHD diagnosis. Inattentive and hyperactive behaviours were especially evident in the home rather than school environment. No group differences were found on a measure of selective attention.  <b>Conclusion:</b> The results of the present study provide further showed that children born very preterm show attentional problems during middle childhood.	0.38-0.58	+ Multi-method/informant design - Small samples sizes, particularly for regression analyses - No statistical control for selection factors associated with prematurity (i.e., SES, maternal education) - Limited generalisability due to high functioning samples

Table 3.1 (continued) Prior Studies Examining the Social Competence of Children Born Preterm in Early and Middle Childhood

Dev. Period	Author/s	Sample	Age Seen	Study Design	Domain	Measures	FINDINGS	Effect Sizes (D)	Strengths & Challenges
Middle Childhood (5-10 years) continued	Rickards, et al. (1993) AUSTRALIA	VLBW $n=132$ BW<1,501 g [excluded children with cerebral palsy and poor vision]  Term $n=60$ BW>2,500 g	8 years corrected	Longitudinal	Behavioural adjustment	Child Behaviour Checklist (CBCL)  Adelaide Teachers' Rating Scale (ATRS)	Teachers rated VLBW children as less forthcoming and assertive ( $p<.02$ ) than full term counterparts. No group differences were found on maternal report measures of depression and anxiety.  <u>Conclusion:</u> VLBW children were less forthcoming-assertive within the school environment.	0.45  NS	+ High retention rates - Randomly selected control group
	Anderson, et al. (2003) AUSTRALIA	ELBW/VPT $n=298$ BW<1,000 g or GA<28 wks  Term $n=262$ BW>2,499 g	8 years	Longitudinal	Behavioural adjustment	Behaviour Assessment System for Children (BASC)	Compared to full term counterparts, parent report showed ELBW/VPT children had more inattention ( $p<.001$ ), hyperactivity ( $p=.003$ ) and somatic complaints ( $p<.001$ ). Teacher report revealed similar findings.  <u>Conclusion:</u> ELBW/VPT children born in the 1990s remain at greater risk of later inattention and internalising behavior problems.	0.10 - 0.27	+ Samples matched for sex, mother's country of birth and health insurance
	Hille, et al. (2001) NETHERLANDS GERMANY CANADA USA	ELBW $n=408$ BW<1,000 g  Term $n=2,852$	8-10 years	Cross-cultural	Behavioural adjustment	Child Behaviour Checklist (CBCL)	Across all four countries, results showed ELBW children were more inattentive than each country-specific reference group. No group differences were found on measures of externalising behaviour. Links between ELBW and greater internalising behaviour problems were found in one cohort.  <u>Conclusion:</u> Due to the few significant differences across cultures, the authors suggest biological mechanisms contribute to behavioural problems of ELBW children.	Required figures not provided	+ Cross cultural design - Cohorts differ in birth years - Sole informant



*Table 3.1 (continued) Prior Studies Examining the Social Competence of Children Born Preterm in Early and Middle Childhood*

Dev. Period	Author/s	Sample	Age Seen	Study Design	Domain	Measures	FINDINGS	Effect Sizes (D)	Strengths & Challenges
Middle Childhood (5-10 years)	Bayless, et al. (2008) UK	VPT <i>n</i> =69 GA<32 weeks  Term <i>n</i> =70	6-12 years	Case-Control	Behavioural adjustment  Interpersonal social behaviour	Strengths and Difficulties Questionnaire (SDQ)	Compared to full term children, parent report showed that children born very preterm were at an elevated risk of emotional symptoms ( $p<.05$ ). Conduct problems, hyperactivity/inattention and peer relationship problems were similar across both groups.  <u>Conclusion:</u> Children born very preterm are at greater risk of internalising behaviour problems, especially those born at earlier gestational ages.	0.36	Poor recruitment rates 30%

Effect size definitions: small (0.10-0.30); medium (0.30-0.50); large ( $\geq 0.50$ ).

## Chapter 4

### Possible Mechanisms Influencing Associations between Very Preterm Birth and Social Competence

Consistent with a developmental perspective, this chapter aims to identify clues in the literature with regards to potential infant clinical factors that may place children born very preterm at elevated risk of poor social competence. Adopting an integrative theoretical approach, possible socio-familial risk factors associated with emotional regulation, behavioural, social cognitive and interpersonal behavioural outcomes are also discussed.

#### *4.1 Infant Clinical Factors and Social Competence*

As evident in the previous chapters, the social competence of very preterm children may be adversely influenced by several infant clinical characteristics. These factors are further examined below with the intent of highlighting possible contributors to social competence outcomes amongst very preterm children.

##### *4.1.1 Gestational Age*

Existing evidence suggests that social competence outcomes may vary depending on the extent of prematurity. For example, groups of preterm infants born at lower gestational ages may be at greater risk of emotional dysregulation and inattention during infancy (Als et al., 1988; Duffy et al., 1990; Feldman, 2006; Mouradian et al., 2000). While it will be important to consider the role of continuous measures of gestational age within very preterm samples, the increased likelihood of adverse developmental outcomes amongst those preterm infants and children characterised by lower gestational age may be due, at least in part to associated clinical complications (Duffy et al., 1990; Mouradian et al., 2000; Sajaniemi et al., 1998). However, the apparent relations between the clinical presentation of very preterm

infants and compromised social development require further investigation as poor social outcomes have also been found amongst very preterm children (GA<34 weeks) born free from significant clinical complications (Mouradian et al., 2000).

#### *4.1.2 Birth weight*

Relative to their full term peers, school-aged children characterised by low birth weight have been found to be at elevated risk of neuro-sensory disorders, inattention, cognitive impairment and behavioural problems (Taylor et al., 2000a). In addition, children born low birth weight may be characterised by more severe educational difficulties, higher rates of special education placement and more grade repetition (Bhutta et al., 2002; Breslau, Brown, Deldotto, & Kumar, 1996; Horwood, Mogridge & Darlow, 1998; Klebanov, Brooks-Gunn, & McCormick, 1994). These studies have been largely based on the examination of outcomes in relation to birth weight categories. However, a longitudinal study by Stoelhorst, et al. (2003) examined the developmental outcomes of a regional cohort of 266 very preterm (GA <32 weeks) Dutch infants at ages 18 and 24 months using the Bayley Scales of Infant Development (Stoelhurst et al., 2003). Results showed that a continuous measure of birth weight was a significant independent predictor of delayed psychomotor development amongst very preterm infants at age 24 months. This indicates that developmental compromise is more evident amongst those lower birth weight very preterm infants whether birth weight is used as a continuous or categorical variable, and supports suggestions that decreasing birth weight may be associated with an increasing gradient of negative developmental outcome (Breslau et al., 1996; Horwood et al., 1998). Much less is known, however, about the role of birth weight in the development of social competence amongst children born very preterm, particularly during the early childhood period.

#### *4.1.3 Gender (Male)*

By contrast, the impact of gender differences on social competence, or at least its behavioural contributes, in very preterm samples has been well documented. For example, a recent examination of the behavioural adjustment of 402 VPT/VLBW and 6,007 full term children at age 5 years showed that males born VPT/VLBW were characterised by more social problems ( $p<.05$ ) while VPT/VLBW females showed more social withdrawal ( $p<.05$ ) (Reijneveld et al., 2006). Gender differences amongst those born premature are also evident during late childhood and adolescence, with preterm males exhibiting more behavioural adjustment problems than their female counterparts. Across studies these difficulties include hyperactivity and aggression ( $p<.01$ ), delinquent behaviour ( $p<.05$ ) and elevated rates of ADHD ( $p=.05$ ) (Elgen et al., 2002; Grunau et al., 2004; Taylor et al., 2000b; Tessier et al., 1997). Increased risk of compromised behavioural adjustment in males born preterm may be due to their greater susceptibility to clinical risk (Bhaumik, Aitken, Kawahi, Ringer, Orav & Lieberman, 2004; Elsmen, Hansen Pupp, & Hellstrom-Westas, 2004; Lavoie, Robaey, Stauder, Glorieux, & Lefebvre, 1998; Tu, Grunau, Petrie-Thomas, Haley, Weinberg & Whitfield, 2007; Wood, Costeloe, Hennessy, Marlow, & Wilkinson, 2003). Despite evidence suggesting that males born preterm are at elevated risk of adverse social outcomes in middle childhood and beyond, few attempts have been made to examine the role of gender in the development of social competence amongst very preterm children during early childhood.

#### *4.1.4 Infant Clinical Presentation*

In addition to the clinical characteristics already discussed in this chapter, preterm infants are also likely to vary widely in terms of their early neurological, physical and health characteristics and required pharmacological intervention/s. Despite such clinical variation, few efforts have been made to examine associations

between individual infant clinical characteristics and later social outcomes. Rather, researchers to date have primarily opted to examine composite measures reflective of overall infant clinical status in relation to later developmental outcomes (Greene et al., 1983; Landry et al., 1997a; Laucht, Esser, & Schmidt, 1997). For example, a study by Landry, et al. (1997a) examined two groups of low birth weight (GA<36 weeks and BW <1,600 g) infants (37 LBW high medical risk and 42 LBW low medical risk), and 49 full term children at ages 6, 12, 24 using composite measures of medical risk and the Bayley Scales of Infant Development (Landry et al., 1997a). Results showed that high medical risk was associated with elevated risks of cognitive impairment. Although such efforts have been invaluable in terms of identifying relations between greater clinical risk and social compromise, a logical progression seems to be the examination of possible associations between individual infant clinical factors and the later social competence of very preterm children. The identification of specific clinical risk factors could signpost directions for further research and may facilitate efforts to identify early those very preterm children who are likely to be at elevated risk of poor social competence.

#### *4.2 Socio-Familial Characteristics and Social Competence*

Additional to the identification of specific infant clinical risk factors associated with compromised social competence amongst very preterm children, within a developmental perspective it is also important to determine the impact of socio-familial factors. This may be critical given research suggests that very preterm infants may be more vulnerable than full term infants to the negative effects of adverse socio-environmental factors (Alberman, 1994). This may be due to the combined effects of very preterm birth and poor clinical presentation. Furthermore, there is also evidence to suggest that the effects of initial clinical status may attenuated over time due to a

range of social and environmental influences (Laucht et al., 1997). Risk factors that seem to be particularly implicated in the social competence of preterm children are briefly reviewed below.

#### *4.2.1 Socio-Economic Status (SES)*

Outside of the preterm literatures, socio-economic status has long been recognised as a mediator of developmental outcome. This is likely due, at least in part, to the fact that children living in poverty are often considered to be at risk of ‘double jeopardy’ (Parker, Greer, & Zuckerman, 1988), with outcome impacted by a lack of financial resources as well as a number of other risk factors associated with low SES. These factors may include single parenting, lack of family support, elevated levels of family stress, parent mental health issues (Amato & Keith, 1991; Bradley, Whiteside, Mundfrom, Casey, Kelleher & Pope, 1994), and exposure to parenting characterised by less sensitivity, poor responsiveness, more punitive behaviours (McLoyd, 1998) and less availability (Miljkovitch, Blaise, & Halfon, 2007).

While group differences between preterm and full term children in a number of social competence domains tend to be robust to statistical control for SES (Delobel-Ayoub et al., 2006; Gardner et al., 2004; Hack et al., 1994; Reijneveld et al., 2006; Rickards et al., 1993), low SES has been shown to adversely impact the development of social competence amongst preterm samples. For example, low SES has been identified as a predictor of emotional dysregulation (Malatesta et al., 1989a), poor social skills, reduced social acceptance, greater personal-social limitations and externalising behaviour problems (Chen et al., 2004; Hoff et al., 2004; Taylor et al., 2000a) within groups of infants and children who were born preterm. It will therefore be important to consider the role of SES as a potential explainant of between group differences as well as within-group variability in the social competence of children born very preterm.

#### *4.2.2 Parenting Behaviour*

Particular parenting characteristics such as parental warmth, support and acceptance (Maccoby & Martin, 1983) have been shown to facilitate children's development of social competence. Characteristics identified as potentially detrimental to children's social development include high levels of negativity, intrusiveness, control and a lack of supportiveness (Creasey, Ottlinger, DeVico, Murray, Harvey & Hesson-McInnis, 1997; Maccoby & Martin, 1983). More critically, these parenting behaviours have also been shown to influence social competence of children born preterm. For example, a study by Hoff et al. (2004) examined 194 extremely preterm (GA<28 weeks or BW <1,000 g) and 76 full term children at age 5 years using the Parental Sensitivity Assessment Scale (Hoff, Munck, & Greisen, 2004), the Connors Abbreviated Symptom Questionnaire for parents (Goyette, Conners, & Ulrich, 1978) and additional questions about social skills and withdrawn behaviour (Cederblad & Hook, 1984) (Hoff et al., 2004). Results showed that those extremely preterm children exposed to greater parental insensitivity were more likely to be characterised by hyperactivity and reduced social skills (Hoff et al., 2004).

The importance of considering parenting behaviour as a likely influence upon the social competence of very preterm children is further heightened by reports that the parent-infant interactions are often less optimal for preterm than for full term infants. Specifically, relative to parents of full term children, parents of very preterm infants have been described as more intrusive, less informative and poorly matched to their infant's pace and rhythms during interactions (Brachfeld, Goldberg, & Sloman, 1980; Feldman, 2003). Examining the impact of negative parenting behaviour in relation to the social competence of very preterm children during early childhood may offer important clinical contributions.

### 4.2.3 Maternal Psychological Wellbeing

The arrival of a premature baby often results in high maternal psychological distress (Lowenthal, 1987; Singer, Salvator, Guo, Collin, Lilien et al., 1999). This is due to a multitude of reasons, such as the abrupt end to the pregnancy period, feelings of guilt and disappointment, fear concerning the viability of the newborn and parental doubts concerning their ability to care for such a vulnerable infant (Lohr, Gontard, & Roth, 2000; Robson, 1997). Subsequently, mothers of very preterm infants may be at greater risk than mothers of full term infants of depression and anxiety during the neonatal period and beyond (Davis, 1999; Davis, Edwards, Mohay, & Wollin, 2003; Garel, Dardennes, & Blondel, 2006; Kersting, Dorsch, Wesselmann, Ludorff, Witthaut & Pohrmann et al., 2004; Miceli, Goeke-Morey, Whitman, Sipes, Miller-Lancar & White, 2000; Stjernqvist, 1992).

Findings to date suggest that maternal psychological distress may adversely impact the social competence of those born preterm. For example, a study by Miceli et al. (2000) examined 30 VLBW (average BW 1,000 g) infants and their mothers at term, 4, 13 and 36 months of age using the parent Child Behaviour Checklist, the Beck Depression Inventory and the Parenting Stress Index (Miceli et al., 2000). They found that exposure to maternal distress at age 4 months was predictive of later internalising and externalising behaviours amongst VLBW children at age 3 years. Similar links between poor maternal psychological wellbeing and compromised aspects of social competence in preterm children have been found during subsequent developmental periods. For example, a study by Gray et al. (2004) also using the Child Behaviour Checklist found that maternal psychological distress was a persistent predictor of clinically significant behavioural problems in 869 LBW children at ages 3, 5 and 8 years (Gray, Indurkha, & McCormick, 2004). Further, preterm children exposed to prolonged periods of maternal distress may be at greater risk of developmental



compromise (Gray et al., 2004; Miceli et al., 2000; Murray & Cooper, 1997; Zolkowitz, Bardin, & Papageorgiou, 2007). Overall, while studies show that exposure to maternal psychological distress may adversely influence the behavioural outcomes of children born preterm much less is known about the impact of maternal anxiety upon other key developmental domains reflective of and important to the development of social competence amongst preschool-aged children born very preterm.

### *Summary of Causal Processes Overview*

To summarise, a number of infant clinical factors and socio-familial characteristics have been identified as possible contributors to social competence outcomes in preterm children. These include gestational age, birth weight, gender, clinical presentation at term, socio-economic status, parenting behaviour and maternal psychological wellbeing. However, the apparent relations between infant clinical and socio-familial factors and compromised social competence have been predominantly investigated amongst school children born preterm. Consequently, the current study aimed to increase the understanding of the roles played by these clinical factors and socio-familial characteristics in relation to the social competence of preschoolers born very preterm.

## **Aims and Hypotheses**

The preceding literature review suggests that during middle childhood children born preterm are at elevated risk of a range of adverse behavioural and social outcomes. However, much less is known about both the extent of these associations, and the emotional regulation and social cognitive outcomes of very preterm children during the early childhood period. In response to these current gaps in knowledge, this section states the research aims and hypotheses of this dissertation.

*Aim 1.* To compare the emotional regulation abilities of children born very preterm with a comparison group of children born full term at age 4 years (corrected for the extent of prematurity at birth). Three aspects of emotional regulation were assessed based on parent-report, being emotional regulation, self-regulation and emotional control.

*Hypothesis.* Children born very preterm will be characterised by poorer emotional regulation, more self-regulation problems and greater difficulty with emotional control than full term comparison children.

*Aim 2.* To compare the behavioural adjustment of children born very preterm with a comparison group of full term children at age 4 years (corrected for the extent of prematurity at birth). Four aspects of behavioural adjustment were examined based on both parent and preschool teacher report, being inhibitory control, hyperactivity/inattention, conduct problems and emotional symptoms.

*Hypothesis.* Children born very preterm will be characterised by elevated levels of inhibitory control problems, more hyperactivity/inattention, greater conduct problems and more emotional symptoms than full term comparison children, across both home and preschool settings.

*Aim 3.* To compare the interpersonal social behaviour of children born very preterm with a comparison group of children born full term at age 4 years (corrected for the extent of prematurity at birth). Four aspects of interpersonal social behaviour were assessed based on both parent and preschool teacher report. These included play interaction, play disconnection, play disruption and peer problems.

*Hypothesis.* Children born very preterm will be characterised by poorer play interaction, greater play disconnection, and more play disruption and peer problems than full term comparison children, across both home and preschool settings.

*Aim 4.* To compare the social cognition of children born very preterm with a comparison group of children born full term at age 4 years (corrected for the extent of prematurity at birth), using three theory of mind tasks. These included the ‘Sally-Ann’ and the ‘Smarties’ tasks and the ‘Fishing Story’.

*Hypothesis.* Children born very preterm will be characterised by poor theory of mind compared to full term children, across three false belief tasks.

*Aim 5.* To examine associations between a range of infant clinical factors and socio-familial characteristics and social competence outcomes, within a group of children born very preterm.

*Hypothesis.* Social competence difficulties amongst children born very preterm will be significantly correlated with factors such as male gender, low birth weight and gestational age, low SES and negative parenting behaviour.

*Aim 6.* To examine the extent to which poor social competence at age 4 years places both very preterm and full term children at elevated risk of behavioural difficulties and

impaired academic functioning at school by age 6 years. Behavioural adjustment and academic performance were assessed based on qualitative teacher ratings of conduct problems, emotional control problems, hyperactivity/inattention, inhibitory control problems and peer problems, as well as overall academic performance in the subject areas of reading, math, spelling and language comprehension.

*Hypothesis.* Social competence problems amongst very preterm and full term preschoolers will predict later behavioural adjustment difficulties and compromised academic functioning at school.

## Chapter 5

### Research Design

#### *5.1 General Study Overview*

Prior to detailing the methodological characteristics of the current study, it is important to provide a brief overview of the broader context in which this research was conducted. In 1998 a prospective longitudinal study was launched by the Canterbury Child Development Research Group, which aimed to examine a wide range of neurological, cognitive and socio-emotional outcomes associated with very preterm birth. The study sample consisted of two groups. The first group was a regional cohort of 129 preterm infants who were eligible for inclusion in the current study based on the following criteria: birth weight of <1,500 g and/or born at  $\leq 33$  weeks gestation; and admission to a level III Neonatal Intensive Care Unit (NICU) at Christchurch Women's Hospital, New Zealand at some time between November 1998 and December 2000. Infants with congenital abnormalities (e.g., Down's syndrome) and those children whose parents did not speak English were excluded. The final cohort consisted of 110 preterm infants following 10 deaths before term, 4 failures to recruit and 5 refusals to participate. Therefore, excluding deaths, 92% of all remaining eligible infants were recruited. Infants born very preterm were assessed at term, 1, and 2 years of age. Measures included magnetic resonance imaging (MRI), clinical assessments, parental interviews, psychometric testing, cognitive assessments and direct observation. Of the 110 infants recruited, excluding deaths ( $n=3$ ), 96.3% were followed up at age 2 years.

The second group was a regional cohort of 116 full term children who were born at between 37-41 weeks completed gestation, in the same region and during the same time period as the very preterm cohort. Recruited for the purpose of developmental comparisons at age 2 years, these children were identified from hospital birth records

( $n=7,200$  total births) by alternately selecting, in a forward and backward fashion, the previous or next child of the same gender in the hospital delivery schedule. The recruitment rate was 62%. Reasons for non-participation included: untraced (47%); moved overseas (12.5%); refused (12.5%); agreed but not seen within assessment timeframe (24 months  $\pm$  2 weeks) due to illness or family circumstances (28%). To examine the effects of sample selection bias for full term participants, recruited and non-recruited children were compared on a range of clinical and social measures. Results showed measures of birth weight, gestational age, gender, family SES (as defined by the Elly-Irving index; (Elly & Irving, 2003), single parenting and percentages of participants of Maori ethnicity were similar amongst groups of recruited and non-recruited full term children. Consistent with the very preterm group, full term infants with congenital abnormalities or from non-English speaking families were excluded. At ages 2 years, children born full term attended the same developmental assessment as children in the very preterm group.

The present study was undertaken at age 4 years when all study children attended a research assessment at the University of Canterbury Child Development House, which lasted approximately 2.5 hours. Measures included a semi-structured parent-child interaction and the assessment of children's cognitive, social, emotional and behavioural outcomes. In addition, further information was obtained via a parent interview about children's development, health, education, current family situation and experiences in the last two years. Questionnaires were also used to examine the social relationships and emotional and behavioural functioning of children across both the home and preschool settings.

Subsequent to this assessment, all study children attended a further follow-up developmental assessment at age 6 years. As a part of this assessment, information was gathered about children's adjustment to school. The author of the present study

assisted with the transition from the 4- to 6-year developmental follow-up, with input provided concerning the conceptual design, selection of study measures and staff training. With permission of the principal investigator of the overall longitudinal study, a small amount of 6-year data was included in the current study to examine the predictive utility of social competence outcomes at age 4 years. Therefore, some measures examined in the current study were collected either prior or subsequent to the 4-year follow-up developmental assessment. All study children born very preterm were assessed at 4- and 6-years of age following correction for the extent of prematurity. Age correction provides a mechanism for mitigating potentially confounding effects of biological maturity on performance (DiPetro & Allen, 1991). This more conservative approach was adopted in the current study as it does not unduly disadvantage children born very preterm and errs on the side of under- rather than over-estimation of rates of difficulty. Further, this approach is consistent with recommendations made by the Victorian Infant Collaborative Study Group which found that the differences between corrected and uncorrected intelligence scores remained clinically relevant until age 8.5 years in children born extremely premature (Rickards, Kitchen, Doyle & Kelly, 1989). Finally, the author of the current study, along with a research assistant and a research nurse were together responsible for the undertaking of all developmental assessments at age 4 years over an approximately 2 year period.

### *5.2 Sample Characteristics of Study Children Assessed at Age 4 Years*

All study children were invited to attend a developmental assessment at age 4 years. Within the very preterm group, retention rates were high with 97% of children born very preterm assessed. Sample losses at age 4 years included 1 child who was blind and only 1 refusal to participate. Retention at age 4 was also high amongst the

full term group, with 96% of children assessed. Data from 8 additional children was excluded due to: 2 clinical diagnoses ( $n=1$  autistic,  $n=1$  developmental co-ordination disorder); 1 non-English speaking; 3 lost to follow-up; and only 2 refusals to participate. Figure 5.1 details the total number of very preterm and full term comparison children recruited and reasons for exclusion from the analysis at age 4 years.

*Figure 5.1 Flow Chart of Study Participation*

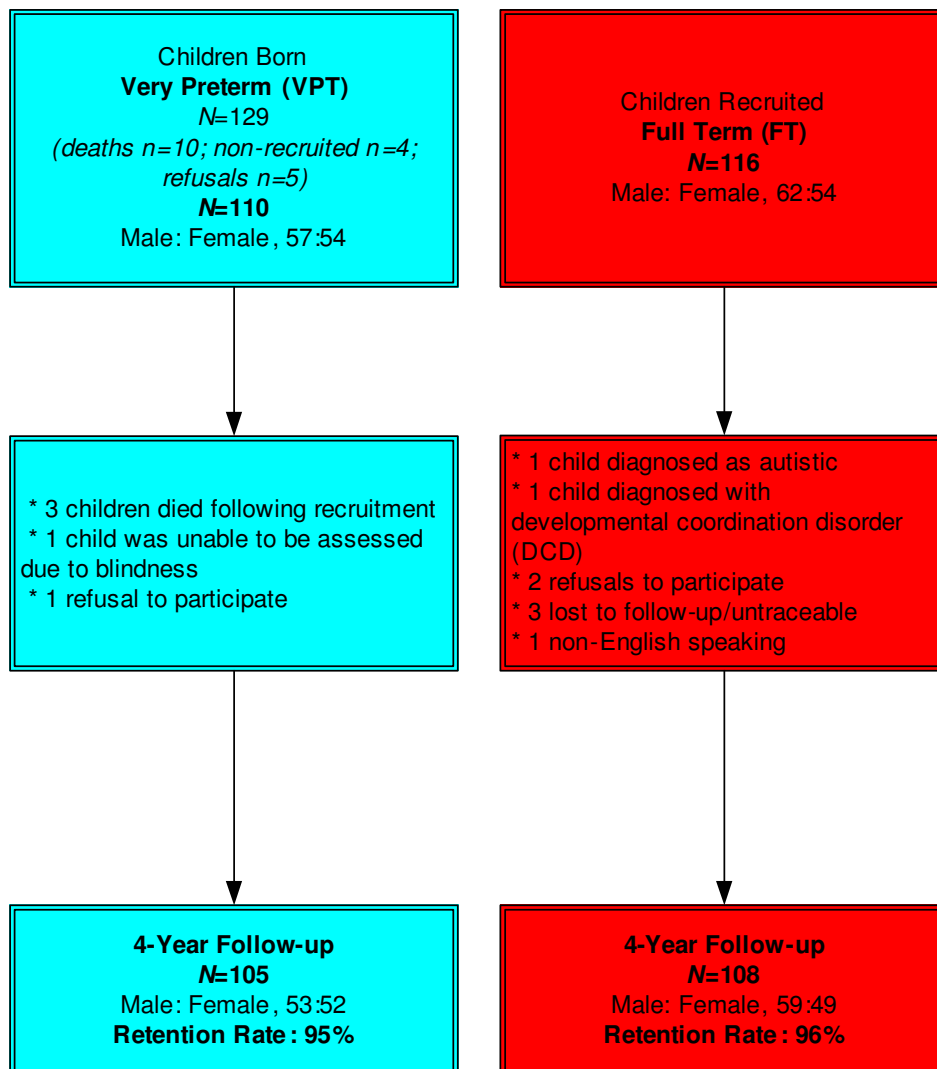




Table 5.1 presents a profile of the clinical characteristics of both very preterm and full term infants at the time of birth. Where available, group comparisons were undertaken using either the  $t$  test for independent samples for continuously distributed variables or the chi-square tests for dichotomous variables. As expected, the results showed that compared to those born full term, very preterm children had significantly lower birth weight ( $p<.001$ ), lower gestational age ( $p<.001$ ) and a greater proportion of multiple births ( $p<.001$ ). In terms of severity of illness at term, compared to full term infants, very preterm newborns had higher rates of IUGR ( $p=.02$ ). Furthermore, 29% of all very preterm newborns had proven sepsis while 45% of all preterm newborns had patent ductus arteriosus (PDA), with 32% requiring pharmacological intervention in the form of indomethacin. In addition, 30% of all very preterm infants had chronic lung disease. Corresponding data was not available for children in the full term group. In terms of the neurological status of infants born very preterm, qualitative evaluations of both white (WM) and grey matter (GM) injury from neonatal MRI showed that 76% of very preterm children were characterised by some form of white matter abnormality (mild  $n=60$ ; moderate  $n=15$ ; severe  $n=4$ ), while 22% of very preterm children had some form of grey matter abnormality. MRI data was not available for the full term comparison group. Gender distribution was similar across both groups. At the time of birth, the social background characteristics of ethnic distribution ( $p=.77$ ) and maternal age ( $p=.85$ ) were similar for both groups. However, the percentages of families characterised by semi-skilled/unskilled socio-economic status ( $p=.04$ ) and mothers leaving school aged between 13-16 years ( $p=.003$ ) were significantly higher in the very preterm group.

Table 5.1 Characteristics of the Sample at the Time of Birth

Measure	Very Preterm (N=105)	Full Term (N=108)	$\chi^2/t$	p
<u>Clinical Factors</u>				
% Male	51.00	54.60	0.36	.54
Mean (SD) Birth weight (grams)	1059.70 (312.17)	3574.50 (409.83)	-50.27	<.001
Mean (SD) Gestational age (weeks)	27.86 (2.34)	39.51 (1.18)	-46.09	<.001
% Intrauterine growth restriction†	7.60	1.00	5.35	.02
% Multiple birth	34.30	3.70	32.64	<.001
% Proven sepsis	29.30	NA	-	-
Mean (SD) Days on oxygen	38.48 (44.28)	NA	-	-
% Chronic lung disease	30.10	NA	-	-
% Patent ductus arteriosus	45.1	NA	-	-
% Indomethacin	32.40	NA	-	-
% Any white matter injury	75.70	NA	-	-
% Any grey matter abnormality	22.3	NA	-	-
<u>Social Background Factors</u>				
% Semi-skilled/Unskilled SES*	22.9	12.0	4.34	.04
% New Zealand European	86.70	88.0	0.08	.77
Mean (SD) Maternal age	30.81 (5.35)	30.95 (4.65)	-0.19	.85
% Mother left school <16 years	40.0	20.6	8.55	.003

† IUGR = birth weight >2 SD below the mean for gestational age. \* Measured by the Elly-Irving Scale (Elly & Irving, 2003). Note: Adjusted for multiple births, these figures are based on the interview of 88 parents of VPT children and 106 parents of full-term comparison children.

### *5.3 Assessment Procedure*

Within two weeks either side of their fourth birthday (corrected for gestational age at birth), all study children attended a research assessment at the University of Canterbury Child Development House. Upon arrival at the research house, each study child's accompanying parent/s were briefed on the developmental assessment, including an outline of the purpose of the overall study, details concerning the requirements of study participants, and reiteration that involvement in the study was voluntary and that information gathered would remain confidential (see Appendix A – Parent/Caregiver Information Sheet). All parental questions or concerns raised were then addressed prior to obtaining written and informed consent for their child/children to participate in this study (see Appendix B – Parent/Caregiver Consent Form). The author of this dissertation and a research assistant administered the child tasks, parental interviews and questionnaires. While efforts were made to ensure that all child measures were administered in a consistent order, task presentation was occasionally varied to accommodate individual circumstances (i.e., if a child was slow to warm up and/or showed initial interest in a particular task). Breaks and refreshments were offered at set points throughout the assessment and stickers were used as incentives for children to complete the tasks. At the conclusion of the assessment, children received a thank-you gift and where appropriate caregivers were reimbursed for travel and accommodation expenses. Measures collected as part of the present study are described below, along with those measures identified from the larger study database used in this analysis.

## 5.4 Study Measures

### 5.4.1 Child Neuro-Developmental Measures (4 Years)

All children were administered the revised version of the Wechsler Preschool and Primary Scales of Intelligence (WPPSI-R; Wechsler, 1989) as part of their 4-year developmental assessment, and in addition to a neurological examination by a paediatric team member.

#### 5.4.1.1 Cognitive Ability.

Children's general cognitive ability was estimated using a short form version of the revised Wechsler Preschool and Primary Scales of Intelligence (WPPSI-R) for children aged 3-7.3 years. The WPPSI-R is a standardised measure which has been shown to be internally consistent, to have good test-retest reliability and to correlate well with the Stanford Binet, McCarthy Scales and Kaufman-Assessment Battery for Children (Sattler, 2001). The Kaufman's short form version of the WPPSI was used to reduce lengthy administration times, and consisted of the following four subtests: the comprehension and arithmetic subtests of the verbal scale; and the picture completion and block design subtests of the performance scale (Sattler, 2001). This version of the WPPSI is reliable, with split half reliabilities ranging from 0.92 to 0.93, and correlations between the short-form and full-scale IQ ranging from 0.89 to 0.92 (LoBello, 1991). Resulting IQ scores were prorated to estimate full-scale IQ scores (Sattler, 2001), with an IQ score of more than 2 SD (IQ score <78) below the control group mean defined as significant cognitive delay.

#### 5.4.1.2 Neuromotor Functioning.

Children born very preterm were assessed for possible cerebral palsy (Domanico et al., 1994), using a standardised paediatric neurological evaluation to

assess the quality of motor skills, coordination, gait and behaviour (Shin'oka, Shum-Tim, & Laussen, 1998). Any resulting diagnoses were based on standard criteria including: anatomic body parts impaired (i.e., hemiplegia, diplegia); degree of impairment to muscle tone and reflexes; and severity of impact on ambulation (Palisano, Rosenbaum, Walter, Russell, Wood & Galuppi, 1997).

#### *5.4.2 Social Competence at Age 4 Years*

The following 6 measures of children's social competence at age 4 years were obtained from parent and/or preschool teacher questionnaires and a battery of research tasks:

##### *5.4.2.1 Emotion Regulation Checklist (ERC).*

The Emotion Regulation Checklist (ERC) is a 24-item parent questionnaire designed to assess children's abilities and strategies for managing emotional experiences (Shields & Cicchetti, 1997). Parents completed the ERC based on their experiences with the target child. All responses were recorded on a 3 point Likert scale: 1=Rarely/Never; 2=Sometimes; 3=Often. The emotional regulation subscale of the ERC was included in the current study and is based on 10 questionnaire items assessing appropriate displays of affect, empathy and emotional self-awareness. Sample items include "Can easily recoup or recover from a stress or upset" and "Shows concern when others are upset or distressed". An emotion regulation score represents the total of the 10 items. A high score indicates appropriate emotional regulation. The minimum score possible was 10 and the maximum was 30. No items required recoding. This scale was found to be internally consistent with a Cronbach alpha coefficient of 0.69. Validity of the ERC has been established through positive correlations with observer ratings of children's regulatory abilities, and the proportions of expressed positive and negative affect (Shields & Cicchetti, 1997).

#### 5.4.2.2 *Infant-Toddler Symptom Checklist (ITSC).*

The Infant-Toddler Symptom Checklist (ITSC) is a parent-report measure designed to provide a profile of children's sensory and regulatory development (DeGangi, 2000a; DeGangi, Poisson, Sickel, & Wiener, 1995). While designed for use with children aged between 7-30 months, the oldest age-specific version (25-30 months) of the ITSC was used in the current study due to reports of usefulness as a screening measure amongst older children (Kristensen & Torgersen, 2006). Parents completed the ITSC based on their experiences with the target child. All responses were recorded on a 3 point Likert scale ranging from 0=Rarely/Never to 2=Often. The self-regulation subscale of the ITSC was included in the current study and is based on 9 questionnaire items designed to assess a child's self-regulatory capabilities. Sample items include 'Frequently irritable and fussy', 'Can't change from one activity to another without distress' and 'Demanding of adult company'. A self-regulation score represents the total of the 9 items. A high score indicates poor self-regulation. The minimum score possible was 0 and the maximum was 18. One item required reverse scoring ('Able to wait for something s/he wants'). This scale was found to be internally consistent with a Cronbach alpha coefficient of 0.77.

The ITSC has been found to discriminate between children with restlessness/ADHD and controls, and strongly correlates with similar items on the Strengths and Difficulties Questionnaire (SDQ) (Kristensen & Torgersen, 2006). Further, the ITSC has demonstrated predictive validity amongst infants with regulatory compromise with regards to later delays in motor, language and cognition and parent-child relationship problems during the early childhood period (DeGangi, Breinbauer, Roosevelt, Porges, & Greenspan, 2000).

#### 5.4.2.3 Behaviour Rating Inventory of Executive Function – Preschool (BRIEF-P).

The Behaviour Rating Inventory of Executive Function – Preschool (BRIEF-P) is a 63-item scale that assesses the everyday executive function behaviours of children between the ages of 2 and 5 years (Gioia et al., 2003). Both parents and preschool teachers completed the BRIEF-P based on their experiences with the target child. All responses were recorded on a 3 point Likert scale ranging from 1=Rarely/Never to 3=Often.

Two subscales of the BRIEF-P were included in this study: emotional control problems and inhibitory control problems. The emotional control problems subscale is based on 10 questionnaire items assessing children's ability to modulate emotional responses. Sample items include 'Overreacts to small problems', 'Mood changes frequently' and 'Reacts more strongly to situations than other children'. An emotional control score represents the total of the 10 items. A high score indicates poor emotional control. The minimum possible score was 10 and the maximum was 30. No items required recoding. This scale was found to be internally consistent with Cronbach alpha coefficients of 0.87 (parent-report) and 0.90 (teacher-report).

The inhibitory control problems subscale is based on 16 questionnaire items assessing children's ability to inhibit an impulse and the ability to stop his/her behaviour at an appropriate time. Sample items include 'Is unaware of how his/her behaviour affects or bothers others', 'Acts wilder or sillier than others in groups (such as birthday parties, play group)' and 'Gets easily sidetracked during activities'. An inhibitory control score represents the total of the 16 items. A high score indicates poor inhibitory control. The minimum possible score was 16 and the maximum was 48. No items required recoding. This scale was found to be internally consistent with Cronbach alpha coefficients of 0.88 (parent report) and 0.94 (teacher report).

The BRIEF-P has been shown to be sensitive to symptoms of ADHD, significantly correlates with ratings on the Conners' Parent Rating Scale (Mahone & Hoffman, 2007), has good test-retest reliability for both parent and teacher report versions, appropriate internal consistency, and has good convergence/discriminane with other preschool measures including the Child Behaviour Checklist (Achenbach & Rescorla, 2000) and the Behaviour Assessment System for Children (Reynolds & Kamphaus, 1992). Furthermore, use of the BRIEF-P in the current study was particularly appropriate, as it has been shown to be sensitive to variations in executive function amongst preterm children (Espy, Kaufmann, & McDiarmid, 1999).

#### *5.4.2.4 Strengths and Difficulties Questionnaire (SDQ).*

The Strengths and Difficulties Questionnaire (SDQ) is a brief and easily administered 25-item behavioural screening questionnaire suitable for use with children aged 4 to 16 years (Goodman, 1997). Both parents and preschool teachers completed the SDQ based on their experiences with the target child. All responses were recorded on a 3 point Likert scale: 0=Not true; 1=Some what true; 2=Certainly true. Scoring was undertaken using SPSS syntax available via the SDQ website ([www.sdqinfo.com](http://www.sdqinfo.com)).

The following four subscales of the SDQ were included in this study: the hyperactivity/inattention; conduct problems; emotional symptoms; and the peer problems subscales. The hyperactivity/inattention subscale assesses children's attention, distractibility and restlessness. Sample items include 'Constantly fidgeting or squirming', 'Thinks things out before acting' and 'Restless, overactive, cannot stay still for long'. A hyperactivity/inattention score represents the total of the 5 items. A high score indicates more hyperactivity and inattention. The



minimum possible score was 0 and the maximum was 10. Two items required reverse scoring (“Thinks things out before acting” and “Sees things through to the end, good attention span”). This scale was found to be internally consistent with Cronbach alpha coefficients of 0.69 (parent report) and 0.86 (teacher report).

The conduct problems subscale is based on 5 questionnaire items assessing children’s temper, obedience and anti-social behaviour. Sample items include ‘Often has temper tantrums or hot tempers’, ‘Generally obedient, usually does what adults request’ and ‘Often fights with other children or bullies them’. A conduct problems score represents the total of the five items. A high score indicates more conduct problems. The minimum possible score was 0 and the maximum was 10. One item (‘Generally obedient, usually does what adults request’) was reverse scored. This scale was found to be internally consistent with Cronbach alpha coefficients of 0.71 (parent report) and 0.79 (teacher report).

The emotional symptoms subscale is based on 5 questionnaire items assessing children’s somatic symptoms, fears, worries and anxieties. Sample items include ‘Often unhappy, downhearted or tearful’, ‘Many fears, scares easily’ and ‘Nervous or clingy in new situation’. An emotional problems score represents the total of the 5 items. A high score indicates greater emotional problems. No items required recoding. The minimum possible score was 0 and the maximum was 10. This scale was found to be internally consistent with Cronbach alpha coefficients of 0.61 (parent report) and 0.77 (teacher report).

The peer problems subscale is based on 5 questionnaire items assessing children’s friendships, popularity and play. Sample items include ‘Has at least one good friend’, ‘Generally liked by other children’ and ‘Rather solitary, tends to play alone’. A peer problems score represents the total of the 5 items. A high score indicates greater peer problems. The minimum possible score was 0 and the

maximum was 10. Two items required reverse scoring ('Has at least one good friend' and 'Generally liked by other children'). This scale was found to be internally consistent with Cronbach alpha coefficients of 0.61 (parent report) and 0.67 (teacher report).

The SDQ is an extensively validated measure with discriminatory ability similar to other established measures of child behaviour, including the longer Child Behaviour Checklist (Achenbach, 1991b) and the Rutter scales (Rutter, 1967) that have been used in both major epidemiological studies and clinical practice (Goodman, 1999; Klasen et al., 2000). The SDQ is also comparable with the Child Behaviour Checklist in the detection of disorders diagnosed through standardised semi-structured interview (Goodman & Scott, 1999), and demonstrates sensitivity in the detection of psychiatric disorder in community and clinical samples (Goodman, 1997). Furthermore, the SDQ has been shown to have strong test-retest reliability and good internal reliability (Mellor, 2004), as well as a recent meta-analysis examining the screening efficiency of the parent report version supporting the use of the SDQ in both clinical and community samples (Warnick, Bracken, & Stanislav, 2008).

#### *5.4.2.5 Penn Interactive Peer Play Scale (PIPPS).*

The Penn Interactive Peer Play Scale (PIPPS) is a 32-item questionnaire used to examine the peer play behaviours of children aged 37 to 64 months (Fantuzzo et al., 1995). Both parents and preschool teachers completed the PIPPS based on their experiences with the target child in the most recent 2-month period. All responses were recorded on a 4 point Likert scale: 1=Never; 2=Seldom; 3=Often; 4=Always. All three subscales of the PIPPS were included in the current study.

The play interaction factor is based on 8 questionnaire items assessing children's play behaviours conducive to successful peer interactions. The teacher version is based on 9 questionnaire items. Sample items include 'Helps other children', 'Positive emotion during play' and 'Encourages others to join play'. A play interaction score represents the total of the questionnaire items contributing to the factor. A high score indicates more positive play interactions. No items required recoding. Minimum scores were 8 for the parent version and 9 for the teacher version. Maximum scores were 32 for the parent version and 36 for the teacher version. This scale was found to be internally consistent with Cronbach alpha coefficients of 0.74 (parent report) and 0.85 (teacher report)

The play disconnection subscale is based on 10 questionnaire items assessing children's withdrawn and avoidant behaviours (Mendez, Fantuzzo, & Cicchetti, 2002). However, the parent version in the current study was based on 9 items as one item was omitted in error from the questionnaire booklet. Sample items include 'Withdraws', 'Refuses to play when invited' and 'Needs help to start playing'. A play disconnection score represents the total of the questionnaire items contributing to the factor. A high score indicates more play disconnection. No items required recoding. Minimum scores were 9 for the parent version and 10 for the teacher version. Maximum scores were 36 for the parent version and 40 for the teacher version. This scale was found to be internally consistent with Cronbach alpha coefficients of 0.88 (parent report) and 0.90 (teacher report)

The play disruption subscale is based on 15 questionnaire items assessing children's aggressive and antisocial behaviours (Mendez et al., 2002). However, the parent version on the current study was based on 14 items as one item was omitted in error from the questionnaire booklet. Sample items include 'Starts fights and arguments', 'Rejects play ideas of others' and 'Cries, whines, shows temper'. A play

disruption score represents the total of the questionnaire items contributing to the factor. A high score indicates more play disruption. Two items required reverse scoring (“Helps settle peer conflicts” and “Comforts others who are hurt or sad”). Minimum scores were 14 for the parent version and 15 for the teacher version. Maximum scores were 56 for the parent version and 60 for the teacher version. This scale was found to be internally consistent with Cronbach alpha coefficients of 0.75 (parent report) and 0.87 (teacher report).

The PIPPS has been shown to be internally consistent (Fantuzzo et al., 1995) and correlates highly with the Social Skills and Problem Behaviors Scales (Hampton & Fantuzzo, 2003). Further, concurrent validity of this measure has been established by comparing the parent and teacher versions to the Social Skills Rating Scale (Gresham & Elliot, 1990), and via the use of peer sociometrics, peer play observations, language abilities and teacher reports of conduct problems, learning behaviours, temperament and social skills (Fantuzzo et al., 1998). Further, the PIPPS has been demonstrated to have predictive validity in relation to later school success (Yumiko, 2006).

#### *5.4.2.6 Social Cognition.*

Children’s social cognition in the form of theory of mind (ToM) was assessed using three false belief tasks. To avoid loss of data and in keeping with previous protocols, children who incorrectly answered any questions pertaining to a single ToM task were recorded as having failed that particular task (Hughes, Adlam, Happe, Jackson, Taylor & Caspi, 2000; Woolfe, Want & Siegal, 2002). Each child received an aggregate ToM score, reflective of the total number of ToM tasks passed. This approach was taken as the reliability of false belief tasks can be markedly improved by summing children’s aggregate scores across a range of false belief tasks

(Hughes & Cutting, 1999; Hughes, Dunn, & White, 1998). A high score indicates greater social cognitive understanding. No items required recoding. The minimum possible score was 0 and the maximum was 3. This scale was found to be internally consistent with Cronbach alpha coefficients of 0.59.

First, all study children were presented with the classic '*Sally-Ann*' unexpected location task (Premack & Woodruff, 1978; Wimmer & Perner, 1983). This task involved a target object (i.e., a ball), two opaque containers (i.e., a box and a basket), two doll characters (Sally and Ann) and an unexpected location. The experimenter confirmed that children knew the name of each doll (2 control-reality questions), and then acted out the following scenario - Sally places her ball inside her basket, prior to leaving the scene. While Sally is absent, Ann removes the ball from Sally's basket and places it inside her box. At this point, the scenario is stopped while children were asked "Did Sally see Ann take the ball out of the basket and put it in the box?" (control-reality questions). The scenario was then completed with Sally's return to the scene. The experimenter then asked children "Where will Sally first look for her ball?" (false belief question). Those children who pointed to the original location of the ball (i.e., Sally's basket) passed the belief question by correctly appreciating Sally's false belief. However, those children who pointed to the more recent location of the ball (i.e., Ann's basket) failed to appreciate Sally's false belief and therefore failed this task. Children were then asked two further questions to assess their understanding of reality and their memory: "Where is the ball really?" (control-reality question) and "Where was the ball in the beginning?" (memory question) (for further detail see Appendix C). Children received 1 point per question that was correctly answered within this task, allowing a maximum score of 6 points. Children were credited with passing the task if they had correctly answered all of the control-reality questions and the false belief question. A pass was recorded as a '1' and a fail was

recorded as a '0'. The 'Sally-Ann' task has been shown to correlate well with the 'Smarties' task (Yirmiya, Erel, Shaked & Solomonica-Levi, 1998) and to have discriminative validity when used to investigate ToM understanding in children with and without autism (Baron-Cohen, Leslie, & Frith, 1985).

Second, all study children were presented with the well-known '*Smarties*' unexpected contents task (Premack & Woodruff, 1978; Wimmer & Perner, 1983). This task involved a prototypical container (i.e., Smarties packet), non-prototypical contents (i.e., crayons) and one doll character (Mickey). The experimenter first showed the prototypical container to the children and asked "What do you think is in this packet?" (control-reality question). Children were then shown that the 'Smarties' packet actually contained crayons. The prototypical packet was then closed. The experimenter then acted out a new character (Mickey) arriving on the scene. Children were then asked the following three questions: "What will Mickey think is inside the packet?" (false belief question); "What is really in the packet?" (control-reality question); and "What does it look like is in this packet?" (control-reality question) (see Appendix C for more detail). Children received 1 point per question that was correctly answered within this task, allowing a maximum score of 4 points. Children were credited with passing the task if they had correctly answered all of the control-reality questions and the false belief question. A pass was recorded as a '1', and a fail was recorded as a '0'. The 'Smarties' task has been shown to correlate well with the 'Sally-Ann' task (Yirmiya et al., 1998), and is known to have discriminative validity when used to investigate ToM understanding in children with and without autism (Nurit, Osnat, Michal, & Daphna, 1998).

The third and final ToM task presented to all study children was the '*Fishing Story*' (Woolfe et al., 2002). This task involved four thought pictures: two of which assessed children's understanding of the characters true belief, and two pictures that

assessed children's ability to understanding the same characters false belief (see Appendix C). The first picture depicted a man who was fishing, with the hook end of the man's fishing line obscured from sight by reeds. In other words, both the children and, hypothetically, the man fishing were unable to see what was on the end of the fishing line. Children were then asked the following four questions about the first picture which were designed to assess their understanding of reality; "What is the man doing?" [correct response: fishing]; "Can you see the end of the fishing line?" [correct response: no]; "Do you think the man can see in the water?" [correct response: no] and "Do you think the man can see under the plant?" [correct response: no].

Children were then shown a second picture depicting the same man fishing. However, this albeit identical picture had a small cardboard flap attached that could be lifted up to reveal the 'catch' on the end of the man's fishing line. This option was not available on the first picture. Children were instructed to lift up the flap, which revealed that the fisherman had caught a boot (shoe) rather than a fish. Once children had viewed the picture and had lifted and replaced the flap, children were asked a further reality-control question: "What can you see on the end of the man's fishing line?" [correct response: a boot (shoe)]. The third picture shown to children depicted the same fisherman with an empty thought bubble above his head. Four separate and smaller pictures were also placed in front of the children. Two of these pictures were distracter items [a hat and a wagon wheel], one showed the content of the fisherman's belief [a fish], and the final picture showed the actual object that was on the end of the man's fishing line [a boot]. Children were asked to indicate which of the four pictures showed what the fisherman was thinking was on the end of his line (false belief question). Children were credited with passing the task if they had correctly answered all of the control-reality questions as well as the false belief question. A

pass was recorded as a '1' and a fail was recorded as a '0'. This final false belief task was selected for use in the current study as a less linguistically challenging ToM task facilitated by a pictorial basis. The Fishing Story is moderately correlated with standard, more verbal false belief tasks, has demonstrated discriminative validity when used to investigate ToM understanding in late and early signing deaf children (Woolfe et al., 2002), and has been used in research examining the neurological underpinnings of theory of mind understanding (Siegal & Varley, 2002).

#### *5.4.3 Antecedent Predictors of Later Social Competence*

Ten measures of infant clinical status following birth were identified from the larger study database. These measures were collected from clinical evaluations as well as infant hospital and medical records during the perinatal period.

1. *Birth weight.* Birth weight was assessed at time of birth (grams) and was recorded as a continuous variable.
2. *Gestational age.* Gestational age was defined as the time from the mother's last menstrual period until birth (weeks) and was recorded as a continuous variable.
3. *Gender.* This was recorded as 0=Female, 1=Male.
4. *Multiple birth.* This was recorded as 0=Singleton, 1=Multiple birth.
5. *Days on oxygen.* Total number of days spent receiving oxygen was recorded as a continuous variable.
6. *CLD.* Defined as oxygen therapy at 36 weeks, the presence of chronic lung disease was recorded as 0=No CLD, 1=CLD.
7. *PDA.* Confirmed by echocardiography (ECG), the presence of a circulation disorder in the form of patent ductus arteriosus was recorded as 0=No PDA, 1=PDA.



8. *Indomethacin*. The receipt of this non-steroidal anti-inflammatory drug, commonly used in the prevention of PDA (Smith & Dewitt, 1996), was recorded as 0=No Indomethacin, 1=Indomethacin.

9. *WMI*. Using MRI data collected at term, composite scores reflective of the extent of infants' white matter injury were created using five qualitative rating scales. These scales assessed white matter signal abnormality, periventricular white matter volume loss, cystic abnormalities, ventricular dilatation, and thinning of the corpus callosum (Inder et al., 2003; Woodward et al., 2004; Woodward et al., 2006). The presence of moderate-severe white matter injury at term was recorded as 0=No moderate-severe WMI (a composite score of 5-9), 1=moderate-severe WMI (a composite score of 10-15).

10. *GMI*. The degree of infants grey matter injury detectable by MRI at term was graded on the basis of the extent of grey matter signal abnormality, the quality of gyral maturation, and the size of the subarachnoid space (Inder et al., 2003; Woodward et al., 2004; Woodward et al., 2006). The presence of any grey matter injury at term was recorded as 0=No GMI (score 3-5), 1=GMI (score 6-9).

#### 5.4.4 *Socio-Familial Measures*

Nine measures of each study child's environmental and family background characteristics were examined, and were based on details either gathered at earlier time points in the overall longitudinal study or those obtained at the four year assessment.

1. *Child ethnicity*. Based on maternal report, child ethnicity was recorded as 0=White/Pakeha/Other European or 1=Ethnic Minority (i.e., Samoan, Maori, Asian or Other).

2. *Maternal age.* The age of each mother at term was recorded in full years as a continuous variable.

3. *Maternal education.* Based on a term maternal interview, levels of maternal education were recorded as 0= High School qualifications or higher, 1= Mother left school between the ages of 13-16 years.

4. *Family socio-economic status (2 and 4 years).* Socio-economic status was assessed using the Elly-Irving Socio-Economic Indices (Elly & Irving, 2003). This index ranks families by occupations classified between '1' (highest level, Professional) and '6' (lowest level, Unemployed). In the current study, a default score of 6 was recorded where no appropriate classification was available (e.g., for 'housewives' and 'students'). Highest family SES was recorded at age 2 and 4 years as a continuous variable. Assigned SES scores show significant correlations with several indicators of socio-economic status, including paternal and maternal education, home ownership, family savings and assets, ratings of living standards and quality of accommodation (Fergusson & Horwood, 1979). The Elly-Irving Index is also closely correlated with The New Zealand Socioeconomic Index of Occupational Status (NZSEI; Davis, McLeod, Ransom & Ongley, 1997).

5. *Siblings.* At age 4 years using parent report each study child's total number of siblings was recorded as a continuous variable.

6. *Caregiver changes.* The total number of caregiver changes experienced by each study child from birth to age 4 years was calculated and recorded as a continuous variable using parent interview data obtained over the course of the study. This measure included any changes in a child's mother- and/or father-figure lasting at least one month (i.e., parental separation, social welfare custody, etc).

7. *Places lived.* Based on parent report, the number of places each study child had resided since birth was recorded at age 4 years as a continuous variable.

8. *Maternal psychological wellbeing (1, 2 and 4 years).* The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) is a 14-item self-report questionnaire used to assess anxiety and depression in non-psychiatric populations (Bjelland, Dahl, Haug, & Necklemann, 2002). This questionnaire was completed when each study child was aged 1-, 2- and 4-years. All responses were recorded on a 4 point Likert scale: 0= Not at all; 1=Occasionally; 2=Quite often; 3=Most of the time.

The anxiety subscale is based on 7 questionnaire items assessing maternal worries and fears. Sample items include “I feel tense or wound up” and “I get sudden feelings of panic”. An anxiety score represents the mean of the combined anxiety scores recorded at each of the 3 time-points. The following item was reverse scored to ensure all data went in the same direction (“I can sit at ease and feel relaxed”). A high mean score indicates greater maternal anxiety. The minimum score possible was 0 and the maximum was 21. This scale was found to be internally consistent with Cronbach alpha coefficients of 0.69 at age 1-year, 0.72 at age 2-years and 0.75 at age 4-years.

The depression subscale is based on 7 items predominantly assessing the ability to feel pleasure (anhedonia). Sample items include “I have little interest in my appearance” and “I feel alone and without friends”. A depression score represents the mean of the combined depression scores recorded at 1-, 2- and 4-years. The following 5 items were reverse scored to ensure all data went in the same direction (“I still enjoy the things I used to”; “I can laugh and see the funny side of things”; “I feel cheerful”; “I look forward with enjoyment to things”; “I can enjoy a good book or radio or TV programme”). A high mean score indicates greater maternal depression. The minimum score possible was 0 and the maximum was 21. No items required recoding. This scale was found to be internally consistent with

Cronbach alpha coefficients of 0.78 at age 1-year; 0.68 at age 2-years and 0.76 at age 4-years.

The HADS has been designed to be valid with clinical populations by avoiding items that may be endorsed due to physical rather than psychological states, has demonstrated internal consistency, has good test-retest reliability (Herrmann, 1997) and is as sensitive as similar screening instruments, including the Beck Depression Inventory (Beck, Rush, Shaw, & Emery, 1979), the Montgomery Asberg Depression Rating Scale (Montgomery & Asberg, 1979) and Spielberger's State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1970). Further, the HADS has previously been used with pregnant Australian women (Quinlivan, Tan, Steele, & Black, 2004) and demonstrates good sensitivity and specificity for both anxiety and depression (Bjelland et al., 2002).

*9. Negative parenting behaviour (4 years).* At the start of each child's 4-year developmental assessment, a structured parent-child interaction took place, which was videotaped for subsequent coding. Before beginning the activity, the four problem-solving tasks were explained to the parent while a second researcher with a toy distracted the child. Parents were instructed to introduce one problem-solving task to their child at a time and in a set order. Once the child had been given a few minutes to explore each new task as it was introduced, parents were told that they could then provide whatever assistance they felt necessary to assist their child with successful completion of the task. Once it was indicated that the parent understood the procedure, the researchers left the room and video recording began.

The first task consisted of a 10-piece wooden jigsaw puzzle of a teddy bear. The second task involved a magnetic letter board with children required to copy the word 'flower' using magnetic letters. All of the letters of the alphabet were available, and the children had to select those letters of the same colour to place on

the board. The third task required the children to replicate a large model of a castle using large ‘Duplo’-type blocks, and the fourth was a bead threading task which required children to replicate a given pattern using beads of differing shapes and colours. Based on the videotaped parent-child interactions, several parent behaviours were later coded. Specifically, for each problem-solving task, the following two parenting behaviours were rated according to previously used coding schemes shown to have discriminate validity with regard to the prediction of child outcomes (Belsky, Jaffee, Sligo, Woodward, & Silva, 2005; Chase-Lansdale, Brooks-Gunn & Zamsky, 1994) (for greater detail see the relevant section of the manual shown in Appendix D – Coding Guidelines for Parenting Behaviour).

The *Negative Affect* scale assessed the frequency and intensity of parental disapproval, negativity and anger. Observations were recorded on a 5 point Likert scale: 1=No evidence of negative affect; 2= Slight expression of negative affect; 3=Three to five expressions of negative affect; 4=Frequent evidence of negative affect; 5=High intensity and frequent negative affect. The minimum score possible was 1 and the maximum was 5. No items required recoding. The overall mean negative affect rating was used in the current study, based on the average of scores across the four tasks completed. A high score indicated more parental negative affect. This scale was found to be internally consistent with a Cronbach alpha coefficient of 0.80 across the four observed activities, and levels of inter-rater reliability were excellent (ICC 0.84; CI 0.66-0.93) (Fleiss, 1981).

The *Intrusiveness* scale assessed the frequency and intensity of parental behaviour that was excessively controlling, poorly timed and intrusive. Observations were recorded on a 5 point Likert scale: 1=No evidence of intrusiveness; 2= One verbal intrusion; 3=One instance of physical intrusion, or two instances of verbal intrusions; 4=Several combined types of intrusiveness; 5=Frequent intrusiveness.

The minimum score possible was 1 and the maximum was 5. No items required recoding. The overall mean intrusiveness rating was used in the current study, based on the average of scores across the four tasks completed. A high score indicated more parental intrusiveness. This scale was found to be internally consistent with a Cronbach alpha coefficient of 0.78 across the four observed activities.

Three raters independently coded tapes following training by the same clinical psychologist. Training took place over a 3-month period and was based on the independent coding of parental behaviours within a group setting. This allowed subsequent ratings to be discussed, with any arising disagreements in coding resolved by consensus. Following the training period, regular monitoring was undertaken to ensure high levels of inter-observer agreement were maintained and to avoid observer drift. Interrater agreement was assessed across 20% of all videotapes. The results of inter-rater reliability analyses, using the Intraclass Correlation Coefficient (ICC; Shrout & Fleiss, 1979), showed that the levels of inter-rater reliability achieved were excellent (ICC 0.83; CI 0.63-0.93; Fleiss, 1981).

The parenting measures of negative affect and intrusiveness were considered to be conceptually representative of overall negative parenting behaviour. Both measures were moderately correlated with another ( $r=0.53$ ). Subsequent principal component analysis (PCA) revealed this model accounted for 76% of the total variance (factor loadings  $>0.86$ ) amongst the full term sample. The replication of this analysis with the 1) very preterm sample (factor loadings  $>0.89$ ) and the 2) total study sample (factor loadings  $> 0.81$ ) confirmed the presence of a single factor reflecting the extent of negative parenting behaviour (see Table 7.7). Based on these results, the two measures were then summed to create a composite measure reflective of overall observed negative parenting behaviour.

#### 5.4.5 School Functioning at Age 6 Years

As part of a subsequent developmental assessment at age 6 years (corrected for gestational age at birth), each child's classroom teacher was asked to complete an extensive questionnaire measure about their impressions of children's academic achievement, as well as their emotional, behavioural and social adjustment to school. Further questions were asked about children's every day executive functioning capabilities, peer relationships and levels of attendance. While the author of the current study had input into the design of the questionnaire, a fellow researcher and a research assistant collected the 6-year data.

*Behavioural Adjustment.* The following subscales of a range of standardised measures were used to assess teacher's perceptions of children's behavioural adjustment within the school environment at age 6 years: conduct problems (SDQ); hyperactivity/inattention (SDQ); inhibitory control problems (BRIEF-P); emotion control problems (BRIEF-P); and peer relationship problems (SDQ). Detailed information concerning both the SDQ and BRIEF-P has been provided earlier in this section as the same measures were used to assess children's social competence at age 4-years.

*Academic Functioning.* Class teachers qualitatively rated each study child's school academic achievement in the subject areas of reading, spelling, language comprehension and math. In each subject, classroom teachers were asked to indicate whether children's current functioning relative to their classroom peers was 1) delayed, 2) below average, 3) average, 4) above average or 5) advanced. Teacher's qualitative ratings of performance in all subject areas were significantly correlated with similar and concurrent measures of early educational achievement ( $r$ 's = 0.48-0.68) assessed using the Woodcock Johnson-III Tests of Achievement (W-J-III; Woodcock, McGrew, & Mather, 2001).

## *5.5 Data Management and Analysis*

### *5.5.1 Data Entry*

All questionnaire, interview and observational data were sent to an external data processing centre. Keyed data was returned in an electronic (.txt) format and saved as a 'master' SPSS file. Following data entry and cleaning, 10% of all data was double-checked with original paper records. Missing data was recoded as appropriate. Necessary scoring was undertaken using specifically written SPSS syntax. 'Master' files were then copied and re-labelled as a 'working' version for subsequent analyses. Regular backups were made of all electronic data files, which were stored in several locations. Original paper scoring sheets for each child were filed in a lockable data room with controlled key access.

Perinatal, clinical and neurological data for each study child were obtained from SPSS files created prior to the undertaking of the current study. Relevant data was then merged into the main SPSS data file used for analyses in this dissertation.

### *5.5.2 Missing Data*

Data was only imputed on standardised questionnaire measures where both parent and teacher report data were collected. This was done in order to avoid sample size reduction resulting from listwise deletion of cases with missing values. Specifically, using the relevant group mean, a small number of data was imputed in cases where a completed questionnaire had been received from a child's parent but not from their teacher data (or vice versa) (very preterm  $n=3$ ; full term  $n=2$ ).

### *5.5.3 Data Reduction*

Principal Components Analysis (PCA), using the Kaiser Criterion (i.e., only factors with Eigen values greater than 1 were retained), was undertaken to statistically verify data reduction in this dissertation. Following the confirmation of a



single factor (both statistically and conceptually), a second stage of PCA analysis was undertaken. This involved the original PCA analyses being re-run separately for each group (very preterm and full term), as well as the total study sample. Providing the subsequent results were consistent, scores conceptually and statistically hypothesised to tap into similar constructs were then transformed into z-scores and reverse scored where appropriate. Relevant scores were then summed to create composite measures with a mean of 100 and a standard deviation of 10.

#### *5.5.4 Effect Size Estimates*

Measures of effect size for continuous variables were calculated using Cohen's 'd'. This measure is defined as the standardised difference between group means or proportions (Cohen, 1977), with resulting effect sizes interpreted using Cohen's criteria (Cohen, 1988). Specifically, effect sizes for univariate analyses were defined as small (0.10-0.30), medium (0.30-0.50) or large ( $\geq 0.50$ ). Alternatively, effect size estimates for dichotomous variables were calculated using Odds Ratios (OR). This represents 'the change in odds of being in one of the categories of outcome when the value of a predictor increases by one unit' (Tabachnick & Fidell, 2007). An odds ratio of 1 indicates that the condition or event under study is equally likely to occur in both groups. An odds ratio of greater than 1 indicates that the condition or event is more likely to occur in the first group, whereas an odds ratio of less than 1 indicates that the condition or event is less likely to occur in the first group.

#### *5.5.5 Statistical Analyses*

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 15.0, using both parametric and non-parametric tests where

applicable. Statistical significance was set at  $p < .05$ . Analyses were organised into four sections, according to the study aims. First, group comparisons on measures of emotional regulation, behavioural adjustment, interpersonal social behaviour and social cognition were examined using either the  $t$  test for independent samples or the chi-square test for dichotomous variables. Analysis of covariance (ANCOVA) was used to statistically control for the potentially confounding effects of selection factors associated with prematurity. Second, following the use of Principal Components Analysis (PCA) to create robust composite outcome measures, correlational, univariate and multiple regression analyses were used to identify infant clinical factors and socio-familial characteristics associated with elevated risks of social competence problems in children born very preterm at age 4 years. Third, interaction effects amongst the predictor variables per model were then assessed using repeated multivariate analyses. Finally, correlational, bivariate and linear regression analyses were used to examine the extent to which overall social competence problems at age 4 years placed very preterm and full term children at subsequent risk of academic difficulties and behavioural problems at school at age 6 years.

## Chapter 6

### Results 1: Neurodevelopmental and Socio-Familial Characteristics at Age 4 Years

Table 6.1 presents a neurodevelopmental profile of the very preterm and full term study participants at corrected age 4 years, including measures of physical disability and cognitive development. Group comparisons were examined using either the  $t$  test for independent samples for continuously distributed variables or the chi-square tests for dichotomous variables.

The results showed that very preterm children were at greater risk than full term children of physical disability. Specifically, 16.2% of children born very preterm were diagnosed with some degree of cerebral palsy (mild  $n=9$ ; moderate  $n=5$ ; and severe  $n=3$ ). Further, very preterm children performed less well than full term children on an estimated global measure of intellectual ability ( $p<.001$ ) with evidence of delays across both verbal ( $p<.001$ ) and performance ( $p<.001$ ) domains. Consistent with this, children born very preterm had higher rates of severe cognitive delay ( $p=.01$ ), defined as an estimated full scale IQ score  $>2SD$  (IQ score  $<78$ ) below the mean of the comparison group ( $M=104$ ,  $SD=13.29$ ).

*Table 6.1 Neurodevelopmental Characteristics of the Sample (4 Years)*

Measure	Very Preterm (N=105)		Full Term (N=108)		$\chi^2/t$	p
<u>Cerebral Palsy</u>						
% Any Cerebral Palsy	16.2		0.9		16.03	<.001
<u>Cognitive Development</u> †	(N=103)		(N=106)			
Mean (SD) Verbal IQ	18.37	(5.13)	20.51	(4.75)	-3.11	<.001
Mean (SD) Performance IQ	18.83	(5.05)	22.47	(4.75)	-5.35	<.001
Mean (SD) Total IQ	95.60	(14.36)	104.70	(13.29)	-4.74	<.001
% Significant Cognitive delay (>2SD; IQ score <78)	9.5		1.9		5.81	.01

†Estimated IQ based on a Short Form of the WPPSI-R.

Table 6.2 presents a social-familial profile of the very preterm and full term study participants at age 4 years corrected. The results show that very preterm children were more likely than the full term children to have families characterised by greater maternal anxiety ( $p=.06$ ), fewer siblings ( $p=.02$ ) and more residential ( $p=.04$ ) and caregiver ( $p=.06$ ) changes. Levels of maternal depression were similar across both groups ( $p=.29$ ).

*Table 6.2 Socio-Familial Characteristics of the Sample (0-4 Years)*

Measure	Very Preterm (N=105)		Full Term (N=108)		$\chi^2/t$	p
Mean (SD) Siblings	1.05	(0.84)	1.34	(0.93)	-2.32	.02
Mean (SD) Caregiver changes	0.46	(1.22)	0.20	(0.67)	1.82	.06
Mean (SD) Places lived	1.84	(1.20)	1.51	(1.03)	2.06	.04
Mean (SD) Maternal anxiety	5.19	(2.83)	4.46	(2.73)	1.84	.06
Mean (SD) Maternal depression	4.85	(2.90)	4.45	(2.61)	1.04	.29

*df*=111. Note: Adjusted for multiple births, these figures are based on the interview of 88 parents of VPT children and 106 parents of full-term comparison children.

## **Results 2: Social Competence of Children Born Very Preterm at Age 4 Years**

The first aim of this dissertation was to examine the extent to which children born very preterm differed from full term comparison children at age 4 years on a range of measures tapping important emerging social competence skills. These measures included the Emotion Regulation Checklist (ERC), the Infant-Toddler Symptom Checklist (ITSC), the Behaviour Rating Inventory of Executive Function - Preschool (BRIEF-P), the Strengths & Difficulties Questionnaire (SDQ), the Penn Interactive Peer Play Scale (PIPPS) and three theory of mind tasks. As noted in the Method section, these measures were selected on the basis of research and theory examining the social competence of both full term and preterm children (Baron-Cohen et al., 1985; DeGangi et al., 2000; Espy, 1997; Fantuzzo et al., 1995; Gioia et al., 2003; Goodman, 1999; Mellor, 2004; Nurit et al., 1998; Shields & Cicchetti, 1997; Woolfe & Want, 2002). Based on the conceptual model presented in Chapter 2 (see Figure 2.1) the following four developmental domains were examined: emotional regulation; behavioural adjustment; interpersonal social behaviour; and social cognition. Across all analyses, between group differences were tested using either the  $t$  test for independent samples for continuously distributed variables or the chi-square tests for dichotomous variables. Effect size estimates were also examined. For continuous variables these estimates were based on Cohen's 'd', which represent the difference between the two means (e.g., very preterm minus full term) divided by the standard deviation of either group. For dichotomous variables effect size estimates were calculated using Odds Ratios (OR). This represents 'the change in odds of being in one of the categories of outcome when the value of a predictor increases by one unit' (Tabachnick & Fidell, 2007). The results of these analyses in relation to each social competence domain are provided below.

*6.1 Emotional Regulation of Children Born Very Preterm and Full Term Comparison Children at Age 4 Years (Corrected)*

Table 6.3 shows the mean scores obtained by very preterm and full term children on the emotional regulation subscale of the Emotion Regulation Checklist (ERC), the self-regulation subscale of the Infant-Toddler Symptom Checklist (ITSC) and the emotional control subscale of the Behaviour Rating Inventory of Executive Function – Preschool (BRIEF-P). The results show that very preterm children were characterised by higher mean levels of emotional regulation difficulties than full term children, spanning poorer emotional regulation ( $p=.01$ ), more self-regulation problems ( $p<.0001$ ) and greater difficulty with emotional control ( $p=.03$ ). Due to the non-normal distribution of data on all measures of emotional regulation, analyses were repeated using the non-parametric Mann-Whitney U test. This analysis yielded a consistent pattern of findings to those shown in Table 6.3. These findings support the first hypothesis by providing clear and consistent evidence of compromised emotional regulation capabilities in children born very preterm. Effect size estimates for these comparisons were small to medium and ranged from  $d=0.30-0.51$ .

*Table 6.3 Emotional Regulation of Children Born Very Preterm and at Term at Age 4 Years*

Measure	Very Preterm ( $N=103$ )		Full Term ( $N=107$ )		$t$	$p$	Effect Size ( $d$ )
Mean (SD) Emotional regulation	25.06	(3.09)	26.12	(2.65)	-2.61	0.01	0.37
Mean (SD) Self-regulation problems	4.61	(3.56)	3.02	(2.46)	3.70	<0.001	0.51
Mean (SD) Emotional control problems	16.12	(4.37)	14.92	(3.43)	2.21	0.03	0.30

$df=199-208$ . Group Means of Raw Scores reported. Effect size definitions: small (0.10-0.30); medium (0.30-0.50); large ( $\geq 0.50$ ). Adjusted for multiple births, these figures are based on the reports of 89 parents of VPT children and 106 parents of full-term comparison children.

## *6.2 Behavioural Adjustment of Children Born Very Preterm and Full Term Comparison Children at Age 4 Years (Corrected)*

Table 6.4 shows the mean scores obtained by very preterm and full term children on a range of parent and teacher reported measures assessing externalising and internalising behaviour. Measures of externalising behaviour include: the inhibitory control problems subscale of the Behaviour Rating Inventory of Executive Function – Preschool (BRIEF-P); and the hyperactivity/inattention and conduct problems subscales of the Strengths and Difficulties Questionnaire (SDQ). Measures of internalising behaviour were based on the emotional symptoms subscale of the Strength and Difficulties Questionnaire (SDQ).

Based on parent report, the results show that compared to their full term counterparts very preterm children were characterised by higher mean levels of both externalising and internalising behaviour problems. These included more inhibitory control problems ( $p=.03$ ), conduct problems ( $p=.01$ ), hyperactivity/inattention ( $p=.01$ ) and emotional symptoms ( $p=.008$ ). Preschool teachers reported similar trends, showing that compared to full term children of the same age, those born very preterm tended to exhibit more externalising and internalising behaviour problems at kindergarten, creche or preschool. However, while there was a trend for elevated levels of inhibitory control problems ( $p=.09$ ) amongst very preterm children in the preschool context, between group differences based on teacher report tended not to reach statistical significance ( $p<.05$ ). Effect size estimates for these comparisons ranged from  $d=0.04-0.37$ , indicating the standardised differences between the two group means were negligible to small. These results suggest that preschool teachers may have been less sensitive to the emotional and behavioural difficulties of children born very preterm compared to their full term peers or that these difficulties amongst very preterm children may be more evident within the home rather than preschool environment.



Due to the non-normal distribution of data across all measures of behavioural adjustment analyses were repeated using the non-parametric Mann-Whitney U test. Non-parametrical tests yielded significant group differences, except for parent reported levels of conduct problems ( $p=.19$ ). Overall, these findings partially support the second hypothesis by suggesting that compared to full term children, those born very preterm have greater difficulty exhibiting appropriate behavioural adjustment in the home environment and also to some extent in the preschool setting.

*Table 6.4 Behavioural Adjustment of Children Born Very Preterm and at Term at Age 4 Years*

Measure	Very Preterm (N=103)		Full Term (N=107)		t	p	Effect Size (d)
<u>Parent report</u>							
Mean (SD) Inhibitory control problems	25.59	(6.03)	23.92	(5.14)	2.15	.03	0.30
Mean (SD) Hyperactivity/inattention	3.82	(2.45)	2.99	(2.20)	2.58	.01	0.36
Mean (SD) Conduct problems	2.68	(2.08)	2.21	(1.67)	1.82	.01	0.25
Mean (SD) Emotional symptoms	2.03	(1.76)	1.44	(1.38)	2.69	.008	0.37
<u>Preschool teacher report</u>							
Mean (SD) Inhibitory control problems	22.68	(7.46)	21.05	(6.55)	1.68	.09	0.24
Mean (SD) Hyperactivity/inattention	2.90	(2.56)	2.34	(2.73)	1.51	.13	0.22
Mean (SD) Conduct problems	1.27	(1.91)	1.19	(1.93)	0.27	.78	0.04
Mean (SD) Emotional symptoms	1.65	(2.04)	1.42	(1.84)	0.86	.38	0.12

$df=208$  for all measures. Group Means of Raw Scores reported. Effect size definitions: small (0.10-0.30); medium (0.30-0.50); large ( $\geq 0.50$ ). Adjusted for multiple births, these figures are based on the reports of 89 parents of VPT children and 106 parents of full-term comparison children.

### *6.3 Interpersonal Social Behaviour of Children Born Very Preterm and Full Term Comparison Children at Age 4 Years (Corrected)*

Table 6.5 shows the mean scores of very preterm and full term children on a range of parent and teacher report measures of interpersonal social behaviour. Measures include the play interaction, play disconnection and play disruption subscales of the Penn Interaction Peer Play Scale (PIPPS), as well as the peer problems subscale of the Strength and Difficulties Questionnaire (SDQ). Compared to children born full term, the results show that parents of very preterm children reported lower levels of successful play interaction with peers ( $p=.04$ ) and elevated rates of peer problems ( $p=.02$ ). More specifically, for example, the peer relationships of very preterm children tended to be characterised by lower levels of: politeness; sharing; positive emotion; and creativity and more solitary play than full term children within the home environment. No such group differences were evident within the preschool environment. Further, according to both parent and preschool teacher report, there were no group differences on measures of play disruption and play disconnection. In other words, for example, across both the home and preschool environments very preterm and full term children were characterised by similar levels of disruption, disagreement, physical aggression, confusion and negative affect during play with peers. Effect size estimates for these comparisons ranged from  $d=0.06-0.31$ , indicating the standardised differences between the two group means were negligible to small. The third study hypothesis being that children born very preterm would be characterised by poorer play interaction, greater play disconnection and play disruption, as well as peer problems compared to full term counterparts was not supported.

*Table 6.5 Interpersonal Social Behaviour of Children Born Very Preterm and at Term at Age 4 Years*

Measure	Very Preterm (N=99)		Full Term (N=106)		t	p	Effect Size (d)
<u>Parent report</u>							
Mean (SD) Play interaction	25.31	(2.83)	26.15	(3.08)	-2.02	.04	0.28
Mean (SD) Play disruption	27.07	(3.86)	26.82	(3.70)	0.47	.63	0.07
Mean (SD) Play disconnection	15.04	(2.96)	14.79	(3.06)	0.58	.56	0.08
Mean (SD) Peer problems	1.62	(1.74)	1.14	(1.40)	2.21	.02	0.31
<u>Preschool teacher report</u>							
Mean (SD) Play interaction	23.30	(4.42)	24.01	(4.58)	-1.12	.26	0.16
Mean (SD) Play disruption	24.01	(6.03)	23.65	(5.70)	0.43	.66	0.06
Mean (SD) Play disconnection	16.29	(5.23)	16.68	(4.53)	-0.56	.57	0.08
Mean (SD) Peer problems	1.90	(1.96)	1.74	(1.94)	0.61	.54	0.08

*df*=208 for parent and teacher peer problems. *df*=203 for all other measures. Group Means of Raw Scores reported. Effect size definitions: small (0.10-0.30); medium (0.30-0.50); large ( $\geq 0.50$ ). Adjusted for multiple births, these figures are based on the reports of 89 parents of VPT children and 106 parents of full-term comparison children.

#### 6.4 Social Cognition of Children Born Very Preterm and Full Term Comparison Children at Age 4 Years (Corrected)

Table 6.6 shows the percentage of very preterm and full term comparison children who were able to correctly respond to all questions concerning each of the three laboratory-based theory of mind tasks, being the ‘Sally-Ann’ and ‘Smarties’ tasks and the ‘Fishing Story’. Compared to children born full term, the results showed that a lower percentage of very preterm children passed each theory of mind task. However, the fourth hypothesis of this study was not supported as between group differences did not reach statistical significance across each task: sally-ann (OR=1.17, 95% CI=0.89-1.55,  $p=.23$ ); smarties (OR=1.48, 95% CI=0.83-2.64,  $p=.12$ ); and fishing story (OR=1.07, 95% CI=0.77-1.49,  $p=.65$ ).

*Table 6.6 Social Cognition of Children Born Very Preterm and at Term at Age 4 Years*

ToM Task	Very Preterm (N=104)	Full Term (N=105)	p	OR	(95% CI)
<u>Sally-Ann</u>					
% Passed	44.2	52.4	.23	1.17	(0.89-1.55)
<u>Smarties</u>					
% Passed	7.7	14.3	.12	1.48	(0.83-2.64)
<u>Fishing Story</u>					
% Passed	23.1	25.7	.65	1.07	(0.77-1.49)

$df=1$  for all tasks. OR denotes odds ratio. CI denotes confidence interval.

In sum, the comparison of very preterm and full term children on a range of measures of social competence at 4 years corrected age revealed some consistent between group differences. Specifically, compared to children born full term parent report suggested that very preterm children had greater difficulty regulating their emotions and maintaining emotional control. For example, very preterm children

tended to be characterised by a poor ability to recoup from stress and to manage excitement, more fussiness and less cheerfulness than full term children. Parent report also revealed that very preterm children had more behavioural adjustment difficulties and less successful play interactions with peers than their full term counterparts. For example, as a group very preterm children were characterised by elevated levels of: inhibitory control problems; conduct problems; hyperactivity/inattention; emotional symptoms; peer conflict; and lower levels of prosocial play behaviours. Preschool teachers tended to report similar observations with some very preterm children characterised by more behavioural adjustment problems, lower levels of successful play interaction, and more play disruption and peer relationship difficulties. However, with the exception of a statistical trend towards elevated risk of inhibitory control problems amongst very preterm children these between group differences were not statistically significant ( $p < .05$ ). Performance on a battery of theory of mind tasks suggested that very preterm and full term children have similar levels of social cognitive understanding at age four years. These findings suggest that being born very preterm may place some children at elevated risk of difficulty in the regulation of emotional and behavioural problems. In contrast, although there was some subtle indication of peer relationship difficulties and poor theory of mind amongst children born very preterm more generally the interpersonal social behaviour and social cognitive understanding of very preterm and full term children at age 4 years were similar.

### *6.5 Development of Composite Measures of Social Competence*

Subsequent study aims included the examination of between group differences on measures of social competence following statistical control for the selection effects of socio-economic status, the examination of the extent of social difficulties reaching clinical significance, and the identification of individual infant clinical

factors and socio-familial characteristics that might predict later social competence problems in children born very preterm. Prior to achieving these aims, data reduction was required in order to reduce the number of dependant variables and to create more psychometrically robust measures of social functioning. Therefore, the following three steps were taken following discussions concerning the conceptualisation of composite measures of emotional regulation, behavioural adjustment, interpersonal social behaviour and social cognition.

1) Variable Correlations: Variables considered conceptually relevant to each developmental domain examined were entered into a correlation matrix. Variables significantly correlated with one another were identified as potential items in the composite measure.

2) Factor Analysis: In order to identify those items representative of a single common factor, correlated variables relevant to each developmental domain were then entered into a principal components analysis (PCA). An individual variable was considered to contribute meaningfully to a single factor if it had a loading of at least 0.5 (or below -0.5).

3) Computation of Scores: Prior to the summation of each composite measure, relevant individual variables were transformed into z scores and standardised into a distribution with a mean of 100 and a standard deviation of 10. Any variables loading negatively onto a factor were reverse scored for ease of interpretation. Totals of each measure included in a composite were not weighted, as all variables within each composite measure were scored on a common metric. Composite scores were then calculated by summing those variables deemed conceptually and statistically relevant. Total scores were then divided according to the number of variables included in each composite. This was done in order to maintain the standardised distribution (mean=100, SD=10). Performance on each composite measure is now discussed.

### 6.5.1 Composite Measure of Emotional Dysregulation

The following parent report measures were considered to be conceptually representative of emotional regulation capabilities: the emotional regulation subscale (ERC); the self-regulation problems subscale (ITSC); and the emotional control problems subscale (BRIEF-P) (see Figure 6.1). All subscales were moderately correlated with one another ( $r$ 's = 0.29-0.57). For ease of interpretation, the emotional regulation total was reverse-scored and re-labelled emotional dysregulation. Subsequent principal component analysis (PCA) revealed that this model accounted for 67% of the total variance (factor loadings >0.72) within the full term sample. The replication of this analysis with the 1) very preterm sample and the 2) total study sample confirmed the presence of a single factor reflecting the extent of emotional regulation problems (see Table 6.7). Based on these results, the three subscales were then summed to create a composite measure of emotional dysregulation. The results from  $t$  tests for independent samples showed that compared to full term children at age 4 years those born very preterm exhibit more emotional dysregulation ( $p=.002$ ). The effect size estimate for this comparison was  $d=.45$  (*very preterm*  $M= 103.83 \pm 11.82$ ; *full term*  $M=99.33 \pm 8.07$ ,  $t(3.17)$ ,  $p=.002$ ), indicating that the standardised differences between the two group means were medium. This composite measure was found to be internally consistent with a Cronbach alpha coefficient of 0.88. Subsequent univariate analyses showed that between group differences remained significant following statistical control for the selection effects of concurrent socio-economic status (*very preterm*  $M=103.47$   $SE=1.01$ ; *full term*  $M=99.65 \pm SE=0.96$ ,  $p=.007$ ).

### 6.5.2 Composite Measure of Externalising Behaviour Problems

The following parent and teacher reported measures were considered to be conceptually representative of externalising behaviour: the inhibitory control

problems subscale (BRIEF-P); the hyperactivity/inattention subscale (SDQ) and the conduct problems subscale (SDQ) (see Figure 6.1). All parent ( $r$ 's = 0.33-0.57) and teacher ( $r$ 's = 0.45-0.76) report subscales were moderately correlated with one another. Subsequent principal component analyses (PCA) amongst the full term sample revealed that the parent report model accounted for 68% of the total variance (factor loadings >0.80), while the teacher report model accounted for 81% of the total variance (factor loadings >0.83). The replication of this analysis with the 1) very preterm sample and the 2) total study sample confirmed the presence of a single factor reflecting the extent of externalising behaviour problems (see Table 6.7). Based on these results, the three parent subscales were then summed to create an externalising behaviour total relevant to the home environment. In addition, the three teacher subscales were summed to create an externalising behaviour total relevant to the preschool environment. The parent and teacher totals were moderately correlated with one another ( $r=0.37$ ). Therefore, the home and preschool scores were then summed to create a composite measure reflective of externalising behaviour across both the home and preschool environments. Subsequent principal component analysis (PCA) revealed that this model accounted for 68% of the total variance (factor loadings >0.80) in the full term sample. The results from  $t$  tests for independent samples showed that compared to their full term peers at age 4 years children born very preterm exhibit more externalising behaviour ( $p=.02$ ). The effect size estimate for this comparison was  $d=.33$  (*very preterm*  $M=102.39 \pm 7.74$ ; *full term*  $M=99.99 \pm 7.05$ ,  $t(2.34)$ ,  $p=.02$ ), indicating that the standardised differences between the two group means were small. Subsequent univariate analyses showed that between group differences remained significant following statistical control for the selection effects of concurrent socio-economic status (*very preterm*  $M=102.37 \pm SE=0.73$ ; *full term*  $M=100.08 \pm SE=0.72$ ,  $p=.03$ ).



### 6.5.3 Composite Measure of Internalising Behaviour Problems

The parent and teacher report measures derived from the emotional symptoms subscale of the Strength and Difficulties Questionnaire (SDQ) were considered to be conceptually representative of internalising behaviour (see Figure 6.1). Parent and teacher subscales were moderately correlated with one another ( $r=0.26$ ). Subsequent principal component analysis (PCA) revealed that the model accounted for 61% of the total variance (factor loadings  $>0.77$ ) amongst the full term sample. The replication of this analysis with the 1) very preterm sample and the 2) total study sample confirmed the presence of a single factor reflecting the extent of externalising behaviour problems (see Table 6.7). Based on these results, the two subscales were then summed to create a composite measure reflective of internalising behaviour across the home and preschool environments. The results from  $t$  tests for independent samples show that compared to full term children at age 4 years those born very preterm exhibit more internalising behaviour ( $p=.02$ ). The effect size estimate for this comparison was  $d=0.32$  (*very preterm*  $M=102.75 \pm 9.52$ ; *full term*  $M=99.99 \pm 7.87$ ,  $t(2.29)$ ,  $p=.02$ ), indicating that the standardised differences between the two group means were small. This composite measure was found to be internally consistent with a Cronbach alpha coefficient of 0.86. Subsequent univariate analyses showed that between group differences remained significant following statistical control for the selection effects of concurrent socio-economic status (*very preterm*  $M=102.68 \pm SE=0.86$ ; *full term*  $M=100.05 \pm SE=0.85$ ,  $p=.03$ ).

### 6.5.4 Composite Measure of Interpersonal Social Behaviour

The following parent and teacher report measures were considered to be conceptually representative of interpersonal social capabilities: the play interaction subscale (PIPPS); the play disruption subscale (PIPPS); the play disconnection scale (PIPPS); and the peer problems subscale (SDQ) (see Figure 6.1). The majority of

parent ( $r$ 's = -0.20-0.45) and teacher ( $r$ 's = -0.56-0.62) report subscales were moderately correlated. However, both the teacher and parent report measures of peer problems (SDQ) were not significantly correlated with corresponding measures of play disruption ( $r$  = -.005-0.13). In order to maintain an even number of measures across the home and preschool contexts both the parent and teacher peer problems subscales of the SDQ were excluded from further inclusion in this analysis. For ease of interpretation, the play interaction totals were reverse-scored to reflect play interaction problems. Subsequent principal component analysis (PCA) amongst the full term sample based on all remaining measures revealed that the parent report model accounted for 56% of the total variance (factor loadings >0.60), while the teacher report model accounted for 63% of the total variance (factor loadings >0.70).

Based on these results, the three parent subscales were then summed to create an interpersonal social behaviour total relevant to the home environment. In addition, the three teacher subscales were summed to create an interpersonal social behaviour problems total relevant to the preschool environment. The parent and teacher totals were moderately correlated with one another ( $r$  = 0.37). Therefore, the home and preschool scores were then summed to create a composite measure reflective of interpersonal social difficulties across the home and preschool environments. Subsequent principal component analysis (PCA) revealed this model accounted for 68% of the total variance (factor loadings >0.80) of the full term sample. The results from  $t$  tests for independent samples show that very preterm and full term children at age 4 years are characterised by similar interpersonal social behaviour problems. The effect size estimate for this comparison was  $d$  = 0.15 (*very preterm*  $M$  = 100.87  $\pm$  5.73, *full term*  $M$  = 99.99  $\pm$  6.26,  $t$  (1.04),  $p$  = .29), indicating that the standardised differences between the two group means were negligible. This composite measure was found to be internally consistent with a Cronbach alpha coefficient of 0.81. As between group

differences were not significant, univariate analyses were not undertaken to examine the selection effects of concurrent socio-economic status.

#### *6.5.5 Composite Measure of Social Cognition*

Three theory of mind tasks were considered to be conceptually representative of social cognitive understanding: the Sally-Ann task; the Smarties task; and the Fishing Story (see Figure 6.1). All tasks were moderately correlated with one another ( $r$ 's=0.14-0.30). Subsequent principal component analysis (PCA) amongst the full term sample revealed that the social cognition model accounted for 49% of the total variance (factor loadings >0.56) amongst the full term sample. The replication of this analysis with the 1) very preterm sample and the 2) total study sample confirmed the presence of a single factor reflecting the extent of social cognitive understanding (see Table 6.7). Based on these results, scores for the three tasks were then summed to create a composite measure of social cognition. The results from  $t$  tests for independent samples show no significant group differences with regard to total social cognitive understanding at age 4 years. The effect size estimate for this comparison was  $d=0.2$  (very preterm  $M=98.04 \pm 9.49$ , full term  $M=100.00 \pm 10.06$ ,  $t$  (-1.44),  $p=.15$ ), indicating that the standardised differences between the two group means were negligible. This composite measure was found to be internally consistent with a moderate Cronbach alpha coefficient of 0.44. As between group differences were not significant, univariate analyses were not undertaken to examine the selection effects of concurrent socio-economic status.

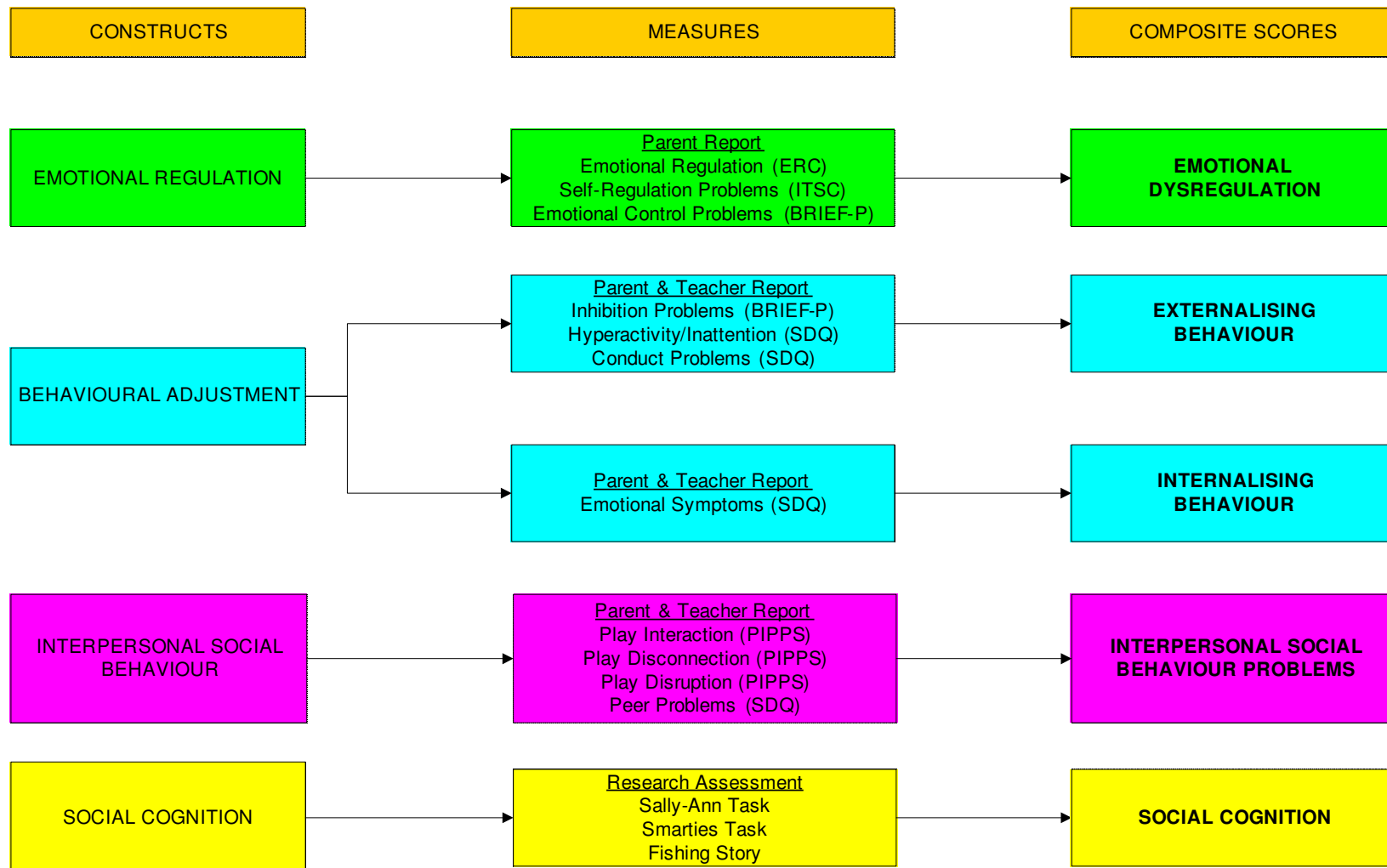
*Table 6.7 Factor Loadings from a Principal Components Analysis of Measures of Social Competence in Very Preterm and Full Term Children*

Measure	Full Sample	Group	
		Very Preterm	Full Term
<u>Emotional dysregulation</u>			
Emotional dysregulation (ERC)	0.72	0.73	0.71
Self-regulation problems (ITSC)	0.87	0.89	0.85
Emotional control problems (BRIEF-P)	0.77	0.83	0.65
<u>Externalising behaviour</u>			
<i>Parent report</i>			
Hyperactivity/inattention (SDQ)	0.86	0.88	0.82
Conduct problems (SDQ)	0.84	0.85	0.81
Inhibitory control problems (BRIEF-P)	0.89	0.92	0.84
<i>Preschool teacher report</i>			
Hyperactivity/inattention (SDQ)	0.92	0.81	0.92
Conduct problems (SDQ)	0.77	0.69	0.84
Inhibitory control problems (BRIEF-P)	0.92	0.91	0.94
<u>Internalising behaviour</u>			
<i>Parent report</i>			
Emotional symptoms (SDQ)	0.79	0.79	0.78
<i>Preschool teacher report</i>			
Emotional symptoms (SDQ)	0.79	0.79	0.78
<u>Interpersonal Social Behaviour</u>			
<i>Parent report</i>			
Play interaction problems (PIPPS)	0.68	0.62	0.74
Play disruption (PIPPS)	0.71	0.79	0.63
Play disconnection (PIPPS)	0.85	0.86	0.85

*Table 6.7 (continued) Factor Loadings from a Principal Components Analysis of Composite Measures of Social Competence in Very Preterm and Full Term Children*

Measure	Full Sample	Group	
		Very Preterm	Full Term
<i>Preschool teacher report</i>			
Play interaction problems (PIPPS)	0.79	0.79	0.79
Play disruption (PIPPS)	0.65	0.57	0.71
Play disconnection (PIPPS)	0.86	0.86	0.87
<u>Social Cognition</u>			
Sally-Ann task	0.68	0.67	0.68
Smarties task	0.78	0.73	0.81
Fishing story	0.63	0.69	0.57

*Figure 6.1 Flow Chart Summarising the Development of Measures of Social Competence*



*6.6 Risk of Clinically Significant Social Competence Problems in Children Born Very Preterm and Full Term Comparison Children at Age 4 Years (Corrected)*

Table 6.8 shows the relationship between birth status (very preterm and full term) at age 4 years and rates of clinically significant emotional dysregulation, externalising and internalising behaviour problems and interpersonal social difficulties. The presence of a clinically significant problem was based on the score distribution of children in the full term group using a 10% cut-point for each measure. This is a popular approach (Delobel-Ayoub et al., 2006; Indredavik et al., 2005; Reijneveld et al., 2006) aimed at increasing measurement consistency and the avoidance of problems associated with the use of test norms, such as the Flynn effect. This effect causes IQ test norms to become dated over time (Kanaya, Scullin, & Ceci, 2003). All associations of risk were quantified using odds ratios (ORs; predicted change in odds of impairment for a unit increase in the predictor) and 95 percent confidence intervals (CI). The results from chi-square tests for dichotomous variables showed that compared to their full term counterparts at age 4 years very preterm children were more likely to exhibit clinically significant levels of emotional dysregulation (OR=3.86, 95% CI=1.81-8.26,  $p<.001$ ), externalising behaviour (OR=1.51, 95% CI=.65-3.43,  $p=.34$ ), internalising behaviour (OR=1.62, 95% CI=.71-3.67,  $p=.25$ ) and interpersonal social difficulties (OR=1.58, 95% CI=.26-1.49,  $p=.29$ ). Corresponding data was unable to be calculated with regards to clinically significant levels of social cognitive difficulties amongst very preterm and full term children due to a lack of variation in overall score distributions.

*Table 6.8 Rates of Clinically Significant\* Social Competence Problems in Children Born Very Preterm and at Term at Age 4 Years Corrected*

Clinically significant problems	Very Preterm (N=103)	Full Term (N=107)	OR (95% CI)	p
% Emotional dysregulation	30.2%	10.5%	3.86 (1.81-8.26)	<.001
% Externalising behaviour	14.6%	10.3%	1.51 (0.65-3.43)	.34
% Internalising behaviour	15.5%	10.3%	1.62 (0.71-3.67)	.25
% Interpersonal social behaviour problems	14.1%	9.4%	1.58 (0.26-1.49)	.29

*df*=1 OR denotes odds ratio. CI denotes confidence interval. \* Clinical significance defined as  $\geq$  the 90<sup>th</sup> percentile of the control group.

#### *Summary of Social Competence of Very Preterm Children at Age 4 Years*

The findings from this part of the study clearly show that compared to full term children at age 4 years those born very preterm are at greater risk of emotional dysregulation and behavioural adjustment difficulties, including both externalising and internalising behaviour. Group differences in behavioural adjustment were more evident in the home environment. Preschool teachers revealed similar yet not statistically significant trends, with the exception of significantly more inhibitory control problems amongst very preterm children. While overall interpersonal social behaviours were similar across both groups there was evidence that very preterm children exhibit more peer problems and lower levels of play interaction within the home environment. While children born very preterm were less likely to pass theory of mind tasks than full term children between group differences did not reach statistical significance. Effect size estimates suggest that the greatest social competence area of difficulty for children born very preterm is that of emotional regulation. This was further reflected by the fact that children born very preterm

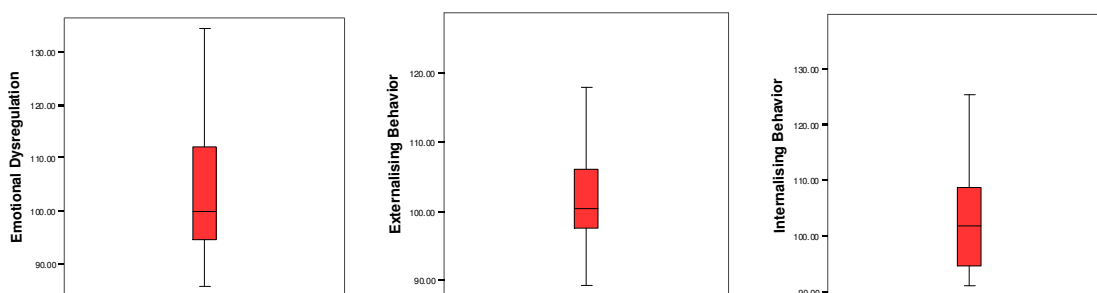


were found to exhibit more emotional dysregulation of clinical significance. While behavioural adjustment and interpersonal social problems were also elevated amongst children born very preterm the extent of these problems tended to be more at sub-clinical levels. Associations between very preterm birth, emotional dysregulation and behavioural adjustment problems at age 4 years were not fully explained by the selection effects of socio-economic status. Given this evidence, it will be important to identify risk factors amongst very preterm children associated with adverse social competence and to identify early those children most at risk.

### Results 3: Clinical and Socio-Familial Predictors of Social Competence Problems in Children Born Very Preterm

Findings to date have shown that compared to their full term peers, children born very preterm were characterised by higher levels of emotional dysregulation and externalising and internalising behavioural adjustment problems by age 4 years. These significant group differences were found to persist following statistical control for the selection effects of family socio-economic status. The poorer performance of children born very preterm combined with the considerable variability in social competence within the preterm group (see Figure 6.2) raises the important question of what infant clinical factors and/or socio-familial characteristics may place preschool-aged children born very preterm at elevated risk of emotional dysregulation and behavioural problems. This represents the second aim of this study.

*Figure 6.2 Variations in Performance on Composite Measures of Emotional Dysregulation and Behavioural Adjustment in Children Born Very Preterm*



To examine this issue the following three steps were undertaken for each outcome of interest.

Step 1. Identifying potential predictors of social competence outcomes. The first step involved examining associations between each composite measure of emotional regulation and behavioural adjustment and a range of infant clinical and socio-familial factors. Based on previous research and theory as discussed in the

Introduction, a range of relevant clinical, environmental and family characteristics were identified from the larger study database. Infant clinical factors included gender, gestational age, birth weight, intra-uterine growth restriction, antenatal and postnatal steroids, patent ductus arteriosus, indomethacin, chronic lung disease and total number of days on ventilation. Two measures of neuro-anatomic injury were also examined, being moderate-severe white matter injury and any grey matter injury. Socio-familial characteristics examined included maternal age at term, maternal education, multiple birth, family socio-economic status (2 years), ethnicity, maternal depression and maternal anxiety (0-4 years), and a composite measure of observed negative parenting behaviour (4 years).

The associations between each possible predictor and social competence outcomes were analysed as follows: a) associations between individual characteristics and outcome measures were first examined using bivariate correlational analyses for continuous variables (see Appendix E – Correlations Matrices: Tables E.1 and E.2) or Cohen's *d* effect sizes for dichotomous variables; b) for illustrative purposes only, where possible any continuous independent variables were then converted into either dichotomous or categorical variables using clinically relevant cut points; c) those independent variables associated with the relevant outcome measure, being significantly correlated with outcome or revealing at least medium effect sizes, were then further examined using the Mantel Haenszel chi-squared test for dichotomous variables or the one-way analysis of variance test for categorical variables (ANOVA); d) independent variables not related with outcome measures were excluded from further analysis.

Step 2. Multiple Regression Analyses. Significant independent variables identified from the above analyses were then entered as continuous variables where possible into a series of linear regression models, using a *Stepwise* procedure. This

enabled the identification of those factors making significant net contributions to each outcome. Since the focus of this analysis was to identify those clinical and socio-familial factors most associated with poor social competence outcomes amongst children born very preterm at age 4 years, full term study participants were not included in this part of the analysis. In fitting each model, predictor variables were entered in a block recursive fashion with infant clinical and neurological factors entered first, followed by measures of family background and functioning. This process was adopted in order to identify possible mediating and/or moderating effects of children's social and family experiences.

Step 3. Examination of Interaction Effects. Infant clinical, socio-environmental and family functioning factors identified as risk factors for poor social competence within each model were then examined for any interaction effects. Interactions between each outcome variable of interest and associated risk factors were examined on the basis of the comparison of group means, the examination of plot graphs and the use of multiple regression analyses. Specifically, per model examinations of interaction effects were examined separately amongst those infant clinical risk factors and socio-familial characteristics associated with poor social outcome. Interaction effects were then examined across infant clinical and socio-familial risk factors identified within each model.

#### *6.7 Emotional Dysregulation of Children Born Very Preterm at Age 4 Years (Corrected) and Associated Infant Clinical and Socio-Familial Factors*

Table 6.9 shows the associations between very preterm children's emotional dysregulation at age 4 years and a range of infant clinical factors. Results show that higher mean emotional dysregulation scores were evident amongst very preterm children characterised by male gender ( $p=.02$ ) and greater neonatal illness, including patent ductus arteriosus ( $p=.03$ ), and the receipt of pharmacological intervention in

the form of indomethacin ( $p=.002$ ). No significant ( $p<.05$ ) associations were found between emotional dysregulation at age 4 years and the following clinical factors: gestational age; birth weight; IUGR; multiple birth; postnatal and antenatal steroids; proven sepsis; total number of days on ventilation; chronic lung disease; white matter injury or grey matter injury.

Table 6.10 shows the associations between very preterm children's emotional dysregulation at age 4 years and a range of socio-familial factors. Results show that higher mean emotional dysregulation scores were evident amongst very preterm children characterised by low socio-economic status ( $p<.001$ ), exposure to high levels of maternal anxiety ( $p<.001$ ) and more observed negative parenting behaviour at age four years ( $p=.05$ ). No significant associations were found between emotional dysregulation at age 4 years and the following socio-familial characteristics: maternal age at term; maternal education; and maternal depression.

### *6.7.1 Predictors of Emotional Dysregulation*

Significant bivariate associations between emotional dysregulation and infant clinical and socio-familial factors were explored further using multiple linear regression analyses. As described in detail earlier, the first model examined the relationship between significant clinical factors shown in Table 6.9 and the outcome measure (Model 1). This initial model was then extended to incorporate significant socio-familial factors shown in Table 6.10 (Model 2). The results of this analysis are shown in Table 6.11. The unstandardised (B) and standardised score ( $\beta$ ) coefficients from the linear regression analyses provide a measure of the mean difference for one unit change in the predictor variable. The standard error (SE) provides a measure of the standard deviation of the sampling distribution, while the  $R^2$  figure is representative of the proportion of variance in the outcome/dependant variable

attributable to the variance of the combined predictor variables. Finally, the F ratio shown for each regression model represents the ratio of the variance estimates.

All infant clinical variables with a significant bivariate association with emotional dysregulation were included in the first stage of the multivariate model. However, as measures of patent ductus arteriosus and the corresponding pharmacological treatment (indomethacin) were highly correlated ( $r=0.66$ ), only the more significant predictor of indomethacin was included in the model to avoid problems of multicollinearity. Therefore, the following two clinical variables were included: male gender and indomethacin. Both infant clinical factors were found to make a net independent contribution to later emotional regulation difficulties. Together, these results suggest that amongst children born very preterm, male infants who received at least one dose of indomethacin around the time of birth were at elevated risk of later emotional dysregulation. These clinical factors accounted for 14% of the total variance in emotional dysregulation outcomes at age 4 years within the preterm group ( $F=7.93$ ,  $p=.001$ ).

This model was then extended to include those socio-familial factors with a significant bivariate association with emotional dysregulation. While negative parenting behaviour was no longer a significant predictor of later emotional dysregulation following the addition of SES to the model, this analysis revealed two familial variables made further contributions to later emotional dysregulation. These were socio-economic status ( $p=.002$ ) and mean maternal anxiety ( $p=.009$ ). In the extended model, the infant clinical characteristics of male gender ( $p=.008$ ) and the receipt of indomethacin ( $p=.002$ ) remained significant predictors of later emotional dysregulation. These results suggest that very preterm children at elevated risk of emotional dysregulation are males who received indomethacin for the treatment of patent ductus arteriosus around the time of birth, and who were raised in a low socio-

economic status environment by a mother experiencing persistently high levels anxiety. In sum, significant infant clinical characteristics included in this model remained significant predictors of emotional dysregulation, even after accounting for significant socio-familial factors. This final two-step model accounted for 31% of the total variance in emotional dysregulation outcomes at age 4 years within the very preterm group ( $F=10.52$ ,  $p<.001$ ). No significant interaction effects were found between the predictor variables of male gender, indomethacin, socio-economic status and mean levels of maternal anxiety.

*Table 6.9 Associations between Infant Clinical Factors and Emotional Dysregulation in Children Born Very Preterm at Age 4 Years*

Clinical Factors	N	Mean (SD) Emotional dysregulation	F	p	d/r
Gestational age					
23-25 weeks	17	106.15 (13.34)	1.33	.26	-0.12
26-28 weeks	42	105.03 (4.44)			
29-33 weeks	37	101.40 (10.81)			
Birth weight					
≤1,000 g	38	107.11 (13.13)	0.11	.89	-0.001
1,001-1,250 g	33	102.34 (10.76)			
≥1,251 g	25	100.81 (10.21)			
IUGR					
Yes	9	107.95 (12.64)	0.02	.27	0.11
No	87	103.40 (11.73)			
Multiple Birth					
Yes	67	103.75 (11.84)	0.05	.91	0.01
No	29	104.02 (12.00)			
Male					
Yes	49	106.54 (12.45)	2.65	.02	0.49
No	47	100.99 (10.53)			
PDA					
Yes	44	101.51 (10.60)	3.29	.03	0.35
No	52	105.72 (13.26)			
Indomethacin					
Yes	32	108.94 (12.46)	2.76	.002	0.69
No	64	101.27 (10.70)			
NEC					
Yes	6	102.23 (8.57)	1.42	.73	0.14
No	90	103.93 (12.04)			
Proven sepsis					
Yes	28	107.72 (12.34)	1.97	.05	0.20
No	67	102.58 (11.31)			



*Table 6.9 (continued) Associations between Infant Clinical Factors and Emotional Dysregulation in Children Born Very Preterm at Age 4 Years*

Clinical Factors	<i>N</i>	Mean (SD) Emotional dysregulation	F	p	d/ <i>r</i>
Antenatal steroids					
Yes	81	102.98 (11.62)	0.003	.10	0.47
No	15	108.41 (12.25)			
Postnatal steroids					
Yes	9	110.85 (13.93)	0.67	.06	0.69
No	87	103.01 (11.43)			
Ventilation					
0 days	30	100.73 (10.49)	1.51	.22	0.13
1-20 days	52	105.28 (12.63)			
≥ 21 days	14	105.04 (10.87)			
CLD					
Yes	32	106.68 (13.03)	3.47	.09	0.37
No	64	102.40 (11.00)			
WMI					
None	22	101.86 (12.40)	1.51	.21	0.20
Mild	55	102.79 (10.32)			
Moderate	15	109.05 (14.88)			
Severe	3	108.88 (16.35)			
Any GMI					
Yes	56	105.08 (12.64)	2.34	.19	0.28
No	39	101.86 (10.52)			

*df*=95 Effect size definitions: small (0.10-0.30); medium (0.30-0.50); large (≥0.50).

*Table 6.10 Associations between Socio-Familial Characteristics and Emotional Dysregulation in Children Born Very Preterm at Age 4 Years*

Socio-Familial Characteristics	<i>N</i>	Mean (SD) Emotional dysregulation	<i>F</i>	<i>p</i>	<i>r</i>
Socio-economic status (2 yrs)					
Unskilled/Unemployed	24	113.91 (13.04)	8.33	<.001	0.28*
Skilled/Semi-skilled	38	102.63 (10.53)			
Professional	34	99.13 (10.93)			
Maternal age (2 yrs)					
<25 years	17	106.68 (10.95)	0.62	.53	-0.15
25-35 years	61	103.37 (11.98)			
>35 years	18	102.66 (12.31)			
Maternal education (2 yrs)					
Left school at 13-16 years	39	104.67 (11.55)	0.46	.62	-0.05
Further secondary/trade	38	102.87 (12.04)			
Higher education	16	101.56 (11.14)			
Mean maternal anxiety (1-4 yrs)					
Low (score<4)	40	100.53 (10.66)	8.32	<.001	0.37*
Medium (score 4-6)	26	101.06 (9.33)			
High (score>6)	30	110.62 (12.67)			
Mean maternal depression (1-4 yrs)					
Low (score 0-3)	45	101.72 (11.59)	2.36	.10	0.15
Medium (score 4-6)	28	103.62 (9.24)			
High (score>6)	23	108.20 (14.17)			
Negative parenting behaviour (4 yrs)					
≤4 displays	83	102.75 (11.45)	-1.94	.05	0.63
≥5 displays	11	109.85 (10.92)			

*df*=95. Effect size definitions: small (0.10-0.30); medium (0.30-0.50); large (≥0.50). \*\**p*<.01, \**p*<.05.

Adjusted for multiple births, these figures were based on the reports of 82 parents/caregivers of VPT children.

*Table 6.11 Significant Predictors of Emotional Dysregulation in Children Born Very Preterm at Age 4 Years*

	<u>Model 1</u>				<u>Model 2</u>			
	(R <sup>2</sup> =0.14, F=7.93, p=.001)				(R <sup>2</sup> =0.31, F=10.52, p<.001)			
	B (SE)		β	p	B (SE)		β	p
<u>Clinical Factors</u>								
Gender (male)	5.33 (2.25)	0.22	.02		5.52 (2.04)	0.23	.008	
Indomethacin	7.50 (2.39)	0.30	.002		7.26 (2.23)	0.29	.002	
<u>Socio-Familial Factors</u>								
Socio-economic status (2 yrs)					2.01 (0.64)	0.28	.002	
Mean maternal anxiety (1-4 yrs)					1.01 (0.38)	0.24	.009	
<i>df</i> =95								

#### *6.8 Internalising Behaviour of Children Born Very Preterm at Age 4 Years (Corrected) and Associated Infant Clinical and Socio-Familial Factors*

Table 6.12 shows the associations between very preterm children's internalising behaviour problems at age 4 years and a range of infant clinical factors. Results show that higher mean internalising behaviour problem scores were evident amongst children born very preterm characterised by lower birth weight. No significant associations were found between internalising behaviour problems and the following clinical factors: gestational age; IUGR; multiple birth; gender; postnatal and antenatal steroids; total number of days on ventilation; chronic lung disease; proven sepsis; patent ductus arteriosus; indomethacin; moderate to severe white matter abnormality or the presence of any grey matter abnormality. Finally, no significant associations were found between the extent of very preterm children's internalising behaviour problems and characteristics of social background and family functioning measured

in the current study. This was evident across both correlational and univariate analyses (see Appendix E – Correlational Matrices: Tables E.1, E.2 and E.5).

Closer inspection of the bivariate relationship between birth weight and internalising behaviour problems using linear regression analyses revealed that birth weight ( $p=.03$ ) made a net independent contribution to later internalising behaviour difficulties. As shown in Table 6.13, these results suggest that very preterm infants characterised by lower birth weight were at increased risk of later internalising behaviour problems. This model accounted for 4% of the total variance in internalising behaviour problems at age 4 years with the very preterm group ( $F=4.25$ ,  $p=.03$ ).

*Table 6.12 Associations between Infant Clinical Factors and Internalising Behaviour Problems in Children Born Very Preterm at Age 4 Years*

Clinical Factors	<i>N</i>	Mean (SD) Internalising behaviour	F	p	<i>d/r</i>
Gestational age					
23-25 weeks	18	105.50 (7.58)	0.95	.38	-0.08
26-28 weeks	45	101.87 (9.39)			
29-33 weeks	40	102.49 (10.40)			
Birth weight					
≤1,000 g	43	104.92 (9.05)	3.06	.05	-0.21*
1,001-1,250 g	34	102.75 (11.09)			
≥1,251 g	26	99.17 (6.17)			
IUGR					
Yes	11	106.73 (8.63)	0.03	.14	0.25
No	92	102.28 (19.11)			
Multiple birth					
Yes	34	102.29 (9.45)	0.00	.98	0.15
No	69	103.68 (9.74)			
Male					
Yes	52	102.03 (8.58)	1.21	.43	0.15
No	51	103.49 (10.43)			
PDA					
Yes	46	103.75 (9.42)	0.33	.34	0.19
No	57	101.94 (9.61)			
Indomethacin					
Yes	35	102.93 (10.20)	0.87	.89	0.03
No	68	102.66 (9.25)			
Proven sepsis					
Yes	29	103.10 (7.75)	4.15	.04	0.06
No	73	102.49 (10.20)			

*Table 6.12 (continued) Associations between Infant Clinical Factors and Internalising Behaviour Problems in Children Born Very Preterm at Age 4 Years*

Clinical Factors	<i>N</i>	Mean (SD) Internalising behaviour	F	p	d/ <i>r</i>
Antenatal Steroids					
Yes	88	102.62 (9.74)	0.99	.73	0.10
No	15	103.52 (8.39)			
Postnatal Steroids					
Yes	11	101.95 (8.87)	0.12	.76	0.10
No	92	102.85 (9.64)			
Ventilation					
0 days	31	102.50 (11.16)	0.51	.60	0.12
1-20 days	58	102.56 (9.00)			
≥ 21 days	14	105.08 (7.85)			
CLD					
Yes	36	104.37 (7.74)	0.78	.37	0.40
No	67	101.33 (7.59)			
WMI					
None	23	101.59 (11.23)	0.13	.94	0.01
Mild	60	102.95 (9.17)			
Moderate	15	102.86 (8.96)			
Severe	4	101.56 (2.60)			
Any GMI					
Yes	61	102.90 (9.27)	0.006	.67	0.09
No	41	102.09 (9.68)			

*df*= 102. Effect size definitions: small (0.10-0.30); medium (0.30-0.50); large (≥0.50).

\*\**p*<.01 level, \**p*<.05

*Table 6.13 Significant Predictors of Internalising Behaviour Problems in Children Born Very Preterm at Age 4 Years*

	<u>Model 1</u>		
	(R <sup>2</sup> =.04, F=4.25, p=.03)		
	B (SE)	$\beta$	p
<u>Clinical Factor</u>			
Birth weight	-0.006 (0.003)	-0.21	.03

df=102

#### *6.9 Externalising Behaviour of Children Born Very Preterm at Age 4 Years (Corrected) and Associated Infant Clinical and Socio-Familial Factors*

Table 6.14 shows the associations between very preterm children's externalising behaviour problems at age 4 years and a range of infant clinical factors. Results show that higher mean externalising behaviour problem scores at age 4 years were evident amongst children born very preterm characterised by male gender ( $p=.01$ ), IUGR ( $p=.02$ ) and more neonatal illness, including patent ductus arteriosus ( $p=.007$ ), proven sepsis ( $p=.03$ ), chronic lung disease ( $p=.05$ ), antenatal steroid use ( $p=.04$ ) and the receipt of indomethacin ( $p=.001$ ). No significant associations were found between externalising behaviour problems at age 4 years and the following clinical factors: gestational age; birth weight; multiple birth; postnatal steroids; total number of days on ventilation; chronic lung disease; white matter injury or grey matter injury.

Table 6.15 shows the associations between very preterm children's externalising behaviour problems at age 4 years and a range of socio-familial factors. Results show that higher mean externalising behaviour problem scores were associated with very preterm children characterised by exposure to higher levels of maternal anxiety ( $p=.01$ ). No significant associations were found between externalising behaviour problems and the following socio-familial factors: socio-

economic status; maternal age at term; maternal education; maternal depression; number of parental changes and negative parenting behaviour.

### *6.9.1 Predictors of Externalising Behaviour Problems*

Significant bivariate associations between externalising behaviour problems, clinical and socio-environmental factors were explored further using multiple linear regression analyses. As described in detail earlier, the first model examined the relationship between outcome and the significant clinical factors shown in Table 6.14 (Model 1). This model was then extended to incorporate significant socio-familial factors shown in Table 6.15 (Model 2). The results of these analyses are shown in Table 6.16. As shown in the first stage of this analysis, only four clinical variables made net independent contributions to later externalising behaviour problems. These were male gender ( $p=.01$ ), chronic lung disease ( $p=.05$ ), patent ductus arteriosus ( $p=.007$ ) and indomethacin ( $p=.003$ ). However, as measures of patent ductus arteriosus and chronic lung disease were correlated ( $r=0.21$ ) only the more significant predictor of patent ductus arteriosus was initially retained in the model. Subsequently, as patent ductus arteriosus and indomethacin were also highly correlated ( $r=0.66$ ), only the more significant predictor of indomethacin was included in the final model to avoid problems of multicollinearity. Together, these results suggest that males born very preterm who received at least one dose of indomethacin around the time of birth were at increased risk of later externalising behaviour problems. This clinical model accounted for 15% of the total variance in externalising behaviour problems at age 4 years within the preterm group ( $F=9.94$ ,  $p<.001$ ).

An examination of the contribution of socio-familial factors also associated with externalising behaviour problems revealed one factor which made net



independent contributions to later externalising behaviour problems; mean maternal anxiety ( $p=.002$ ). In this extended model, the infant clinical characteristics of male gender ( $p=.006$ ) and the receipt of indomethacin ( $p=.005$ ) remained significant predictors of later externalising behaviour problems, following the addition of maternal anxiety ( $p=.002$ ). This final model suggests that male gender, indomethacin around the time birth and higher levels of maternal anxiety placed children at elevated risk of externalising behaviour problems during early childhood. This final model accounted for 23% of the total variance in externalising behaviour outcomes at age 4 years within the preterm group ( $F=10.37$ ,  $p<.001$ ). No significant interaction effects were found between the predictor variables of male gender, indomethacin and maternal anxiety.

*Table 6.14 Associations between Infant Clinical Factors and Externalising Behaviour in Children Born Very Preterm at Age 4 Years*

Clinical Factors	<i>N</i>	Mean (SD) Externalising behaviour	<i>F</i>	<i>p</i>	<i>d/r</i>
Gestational Age					
23-25 weeks	18	103.14 (8.02)	1.18	.31	-0.09
26-28 weeks	45	103.40 (7.46)			
29-33 weeks	40	100.93 (7.88)			
Birth Weight					
≤1,000 g	43	103.73 (7.81)	1.44	.24	-0.06
1,001-1,250g	34	102.15 (17.10)			
≥1,251 g	26	100.50 (6.23)			
IUGR					
Yes	11	104.57 (4.31)	4.87	.02	0.32
No	92	102.13 (8.03)			
Multiple Birth					
Yes	34	102.67 (7.69)	0.03	.61	0.11
No	69	101.84 (7.93)			
Male					
Yes	52	104.25 (7.80)	0.97	.01	0.51
No	51	100.47 (7.26)			
PDA					
Yes	46	104.66 (8.80)	6.57	.007	0.55
No	57	100.57 (6.27)			
Indomethacin					
Yes	35	105.81 (9.22)	8.92	.001	0.70
No	68	100.71 (6.32)			
Proven Sepsis					
Yes	29	104.84 (8.20)	1.28	.03	0.43
No	73	101.44 (7.40)			

*Table 6.14 (continued) Associations between Infant Clinical Factors and Externalising Behaviour in Children Born Very Preterm at Age 4 Years*

Clinical Factors	<i>N</i>	Mean (SD) Externalising behaviour	F	p	d/ <i>r</i>
Antenatal Steroids					
Yes	88	101.77 (7.69)	0.05	.04	0.59
No	15	106.07 (7.22)			
Postnatal Steroids					
Yes	11	103.80 (7.86)	0.04	.52	0.20
No	92	102.23 (7.75)			
Ventilation					
0 days	31	101.10 (6.55)	0.74	.47	0.06
1-20 days	58	103.18 (8.72)			
≥ 21 days	14	101.99 (5.55)			
CLD					
Yes	36	104.37 (7.74)	0.04	.05	0.40
No	67	101.33 (7.59)			
WMI					
None	23	101.27 (7.58)	0.55	.64	0.12
Mild	60	102.20 (7.67)			
Moderate	15	104.15 (8.13)			
Severe	4	104.86 (10.73)			
Any GMI					
Yes	61	103.14(8.32)	1.32	.22	0.25
No	41	101.25 (6.84)			

*df*=102 Effect size definitions: small (0.10-0.30); medium (0.30-0.50); large (≥0.50).

*Table 6.15 Associations between Socio-Familial Characteristics and Externalising Behaviour Problems in Children Born Very Preterm at Age 4 Years*

		Mean (SD)			
Socio-Familial	<i>N</i>	Externalising	F	p	<i>r</i>
Characteristics		Behaviour			
Socio-economic status (2 yrs)					
Unskilled/Unemployed	24	103.45 (7.23)	0.74	.47	0.23
Skilled/Semi-skilled	45	102.78 (7.29)			
Professional	34	101.12 (8.67)			
Maternal age (2 yrs)					
<25 years	17	103.59 (7.95)	0.70	.49	-0.15
25-35 years	67	102.59 (8.07)			
>35 years	19	100.64 (6.31)			
Maternal education (2 yrs)					
Left school at 13-16 years	39	103.36 (7.17)	0.56	.57	0.11
Further secondary/trade	42	101.78 (7.88)			
Higher education	22	101.48 (8.59)			
Maternal anxiety (1-4 yrs)					
Low (score<4)		100.22 (6.00)	4.20	.01	0.34**
Medium (score 4-6)	41	102.04 (6.91)			
High (score>6)	27	105.21 (9.32)			
	35				
Maternal depression (1-4 yrs)					
Low (score 0-3)		102.03 (8.09)	0.10	.90	0.005
Medium (score 4-6)	48	102.73 (6.10)			
High (score>6)	29	102.70 (8.91)			
	26				
Parental changes (0-4 yrs)					
0 parental changes	76	101.87 (7.51)	0.96	.38	0.11
1 parental change	7	103.26 (8.92)			
≥ 2 parental changes	13	105.05 (8.93)			
Negative parenting behaviour (4 yrs)					
≤4 displays	59	102.21 (7.73)	0.01	.98	0.10
≥5 displays	42	102.23 (7.26)			

*df*=102 Effect size definitions: small (0.10-0.30); medium (0.30-0.50); large (≥0.50). \*\**p*<.01 level, \**p*<.05. Adjusted for multiple births, these figures were based on the reports of 86 parents/caregivers of VPT children.

*Table 6.16 Significant Predictors of Externalising Behaviour in Children Born Very Preterm at Age 4 years*

	<u>Model 1</u>				<u>Model 2</u>			
	(R <sup>2</sup> =0.15, F=9.44, p<.001)				(R <sup>2</sup> =0.23, F=10.37, p<.001)			
	B	(SE)	$\beta$	p	B	(SE)	$\beta$	p
<u>Clinical Factors</u>								
Gender (male)	3.83	(1.12)	0.24	.008	3.79	(1.35)	0.24	.006
Indomethacin	5.13	(1.50)	0.31	.001	4.21	(0.25)	0.25	.005
<u>Socio-Familial Factors</u>								
Mean maternal anxiety (1-4 yrs)					0.78	(0.24)	0.28	.002
<i>df</i> =102								

*Summary of Predictors of Social Competence Problems in Very Preterm Children*

In light of the considerable variability evident amongst very preterm children to appropriately manage emotional regulation and behavioural adjustment, bivariate and multivariate analyses were used to identify infant clinical and socio-familial factors associated with poor outcome. Results showed that male children born very preterm, who required indomethacin around the time of birth, and who were raised by mothers experiencing high levels of maternal anxiety across the first four years of life were at elevated risk of emotional dysregulation and externalising behaviour at age 4 years. In contrast, very preterm children characterised by lower birth weight were found to be at elevated risk of later internalising behaviour. These findings partially support the fifth hypothesis with male gender, low SES and lower birth weight being predictive of social competence outcomes. Gestational age and negative parenting behaviour were not significant associated with outcome at age 4 years amongst children born very preterm.

## **Results 4: Predictive Validity of Social Competence Problems at 4 Years**

Findings to date reveal children born very preterm are characterised by more emotional and behavioural adjustment problems at age 4 years than term born children. These group differences persisted following statistical control for selection effects of socio-economic status. Amongst children born very preterm, significant associations were found between several infant clinical characteristics, social background and family functioning factors and later social competence. This chapter addresses the third major aim of this dissertation, being to examine the extent to which children's overall social competence problems at age 4 years were associated with compromised school achievement and behavioural adjustment age 6 years (corrected). The predictive validity of social competence at age 4 years was examined in both the very preterm and full term groups.

### *6.10 Development of an Overall Measure of Social Competence Problems*

Prior to achieving these aims data reduction was required in order to create a more robust measure of total social competence problems at age 4 years. Therefore, the following 3 steps were taken;

(1) Variable Correlations: All social competence measures were entered into a correlation matrix (emotional dysregulation, externalising behaviour, internalising behaviour, interpersonal social behaviour problems and social cognitive understanding). Amongst children born full term, the following subscales were moderately correlated: emotional dysregulation; externalising and internalising behaviour; and interpersonal social behaviour problems ( $r=0.20-0.64$ ). In contrast, the composite measure of social cognition was not correlated with any other measure of social competence examined.

(2) Factor Analysis: In order to identify those measures representative of a single common factor, all significantly correlated measures of social competence were entered into a principal components analysis (PCA). A measure was considered to contribute meaningfully to a single factor only if it had a loading of at least 0.5. In the first instance these analyses were based on data from the full term group. Results from this analysis supported the presence of two factors. Measures loading on the first factor were the emotional dysregulation, externalising behaviour problems and interpersonal social behaviour problems composite scores. The second factor consisted of the total theory of mind and internalising behaviour problems scores, suggesting that these two measures were reflective of differing factors. Therefore, these two measures were excluded from subsequent PCA. Table 6.17 shows that the replication of this analysis with the 1) very preterm sample and the 2) total study sample confirmed the presence of a single factor reflecting the extent of social competence problems. Together, measures of emotional dysregulation, externalising behaviour and interpersonal social behaviour problems accounted for 48% of the total variance (factor loadings  $>0.78$ ) in the total study sample. Therefore, the creation of a composite measure of social competence problems for all children was supported. Subsequently, the three standardised scores described were summed, with the total then divided by the number of composite measures included. The results from  $t$  tests for independent samples showed that compared to children born full term at age 4 years very preterm children had higher mean levels of overall social competence problems (*very preterm*  $M=96.67 \pm 6.98$ , *full term*  $M=94.19 \pm 5.26$ ,  $t(2.85)$ ,  $p=.003$ ). The effect size estimate for this comparison was  $d=0.41$ , indicating that the standardised differences between the two group means were medium.

*Table 6.17 Factor Loadings from a Principal Components Analysis of Measures of Social Competence in Very Preterm and Full Term Children*

Composite	Group					
	Full Sample		Very Preterm		Full Term	
Emotional dysregulation	0.84	-0.007	0.87	0.02	0.80	-0.11
Externalising behaviour	0.84	-0.10	0.85	0.09	0.84	-0.24
Internalising behaviour	0.55	0.37	0.58	-0.02	0.40	0.70
Interpersonal social problems	0.79	0.02	0.83	-0.09	0.76	0.24
Total Social Cognition	-0.14	0.93	-0.01	0.99	-0.24	0.72

#### *6.11 Social Competence of Very Preterm and Full Term Comparison Children at Age 4 Years and Later School Adjustment*

The extent to which total social competence problems at age 4 years was associated with later school behavioural and achievement difficulties at age 6 years was examined amongst both the very preterm and full term groups. School measures of behavioural adjustment included conduct problems, hyperactivity/inattention, inhibitory control problems, emotional control problems and peer problems. Measures of academic performance at school included the extent to which children were characterised by difficulties in the subject areas of reading, spelling, language comprehension and math. In order to ease interpretation of the results, outcome variables at age 6 years were reverse scored where necessary to reflect the extent of difficulty in a particular area, and were transformed into standardised scores with a mean of 100 (SD=10). Using the Pearson correlation coefficient, results showed significant correlations across both groups between overall social competence problems at age 4 years and measures of school behaviour, including more hyperactivity/inattention, inhibitory control problems, emotional control problems,



conduct problems and peer problems ( $r$ 's=0.21-0.53). Correlations were also found between social competence difficulties at age 4 years and later teacher ratings of below average/delayed school achievement across all subject areas, except language comprehension, amongst both very preterm and full term children at age 6 years ( $r$ 's=0.23-0.38) (see Appendix E – Correlations Matrices: Table E.4). For illustrative purposes, both very preterm and full term children were then categorised into percentile groups, based on 25<sup>th</sup> percentile cut points based on the control group distribution of social competence scores. Significant associations were then examined between total social competence problems and later school behavioural and academic functioning using the one-way analysis of variance test.

The results in Table 6.18 show very preterm children who had greater social difficulties at age 4 years were characterised by elevated levels of: hyperactivity/inattention ( $p=.02$ ); inhibitory control problems ( $p=.02$ ); conduct problems ( $p<.001$ ); emotional control problems ( $p=.007$ ); and peer relationship difficulties ( $p=.002$ ) at age 6 years. Similar associations were evident in the full term group. Further, the results in Table 6.19 show those preschool children born very preterm who were characterised by poor social competence were also at increased risk of academic difficulty at school. These findings support the final hypothesis of this study. Specifically, while links between social competence problems and later language comprehension difficulties were not evident ( $p=.15$ ) children born very preterm who were less socially competent at age 4 years were more likely than full term children to be rated by teachers as performing at a below average or delayed level in reading ( $p=.008$ ), spelling ( $p=.006$ ) and maths ( $p=.03$ ). Similar associations were found amongst full term born children, with those characterised by poor social competence at age 4 years being at greater risk of below average or delayed

performance in reading ( $p=.003$ ), spelling ( $p=.001$ ) and math ( $p<.001$ ), but not language comprehension ( $p=.10$ ).

Table 6.18 Social Competence Problems at Age 4 Years and Teacher Reported Behavioural Adjustment at Age 6 Years

Social competence problems	N	Mean (SD) Conduct problems	Mean (SD) Hyperactivity/ inattention	Mean (SD) Inhibitory control problems	Mean (SD) Emotional control problems	Mean (SD) Peer problems
<u>Very Preterm</u>						
Lowest 25%	12	96.72 (4.01)	97.29 (6.45)	99.30 (5.09)	95.73 (4.71)	95.05 (5.61)
26-49%	13	96.97 (5.32)	100.54 (9.66)	99.12 (9.73)	96.98 (5.89)	98.29 (8.72)
50-74%	25	99.02 (8.12)	100.68 (9.10)	101.54 (8.81)	102.28 (10.72)	98.08 (8.18)
Highest 25%	35	103.96 (12.35)**	105.61 (8.97)*	106.96 (10.90)*	104.56 (9.25)**	106.37 (13.37)**
<u>Full Term</u>						
Lowest 25%	24	96.48 (3.48)	94.71 (5.14)	95.67 (4.97)	95.48 (6.28)	97.86 (7.02)
26-49%	24	96.95 (3.61)	97.84 (8.63)	96.76 (7.48)	97.61 (7.32)	97.39 (7.57)
50-74%	26	97.86 (5.52)	99.66 (8.16)	99.09 (8.48)	99.88 (8.99)	99.59 (9.09)
Highest 25%	27	107.27 (15.28)**	106.83 (11.78)**	107.15 (11.74)*	105.80 (11.75)**	104.73 (13.25)*

df=84 (very preterm group), df=100 (full term group) \*\* p<.01, \* p<.05

Table 6.19 Social Competence Problems at Age 4 Years and Teacher Reported Achievement at Age 6 Years

Social competence problems	N	% Below average/delayed Reading	% Below average/delayed Spelling	% Below average/delayed Maths	% Below average/delayed Language comprehension
<u>Very Preterm</u>					
Lowest 25%	12	9.8	9.8	8.3	7.7
26-49%	13	14.6	14.6	13.9	19.2
50-74%	25	24.4	22.0	22.2	23.1
Highest 25%	35	51.2 <sup>***</sup>	53.7 <sup>***</sup>	55.6 <sup>**</sup>	50.0
<u>Full Term</u>					
Lowest 25%	24	8.0	5.0	0.0	14.3
26-49%	24	20.0	20.0	15.4	21.4
50-74%	26	32.0	35.0	15.4	14.3
Highest 25%	27	37.0 <sup>***</sup>	40.0 <sup>***</sup>	69.2 <sup>***</sup>	50.0
df=83 (very preterm group), df=100 (full term group)    *** p<.01,   ** p<.05,   * p<.10					

### *6.12 Social Competence, School Adjustment and Child IQ*

Findings to date have shown that both those very preterm and full term children characterised by greater overall social competence difficulties in early childhood were at greater risk than more socially competent counterparts of poor school behavioural and academic adjustment at age 6 years. These associations raise an important question concerning to what extent these significant links may be due to underlying cognitive impairment amongst both very preterm and full term children. To examine this issue, associations between total social competence problems and later school behavioural adjustment and academic functioning were re-examined in both groups following statistical control for child estimated Full Scale IQ at age 4 years. This was done using linear regression analyses, with estimated Full Scale IQ at age 4 years entered into each model as an additional independent variable. This enabled the examination of the possible effects of children's estimated Full Scale IQ in relation to social competence problems at age 4 years and school behavioural and academic adjustment at age 6 years.

The results in Table 6.20 show that amongst very preterm children while IQ partly attenuated the relationships between total social competence difficulties and school behavioural adjustment problems remained significant across all measures: conduct problems ( $p=.03$ ); hyperactivity/inattention ( $p=.005$ ); inhibitory control problems ( $p<.001$ ); emotional control problems ( $p=.002$ ); and peer problems ( $p=.001$ ). Similar results were found amongst full term children, with all associations between social competence problems and later school behavioural adjustment remaining statistically significant following statistical control for child IQ (see Table 7.19). Further, the results in Table 6.21 show that following statistical control for IQ associations between total social competence problems at age 4 years and compromised academic functioning in reading and spelling at age 6 years were no

longer statistically significant in both very preterm and full term children. However, following control for IQ preschoolers born very preterm characterised by poor social competence at age 4 years tended to remain at an increased risk of math problems ( $p=.08$ ), while full term children remained at an elevated risk of difficulty with spelling ( $p=.01$ ) at school.

Interaction effects were investigated using a series of linear regression models. Using each 6 year behavioural and academic outcome as the dependant measure, total social competence problems and child estimated Full Scale IQ were entered into each model at Step 1 and 2, respectively, with the composite measure of social competence problems X IQ interaction term entered at Step 3. No significant interactions effects were found across both groups concerning behavioural adjustment or academic achievement at school.

*Table 6.20 Social Competence Problems at Age 4 Years and Behavioural Adjustment in Very Preterm and Full Term Children at Age 6 Years*

Class Teacher Ratings	B	(SE)	$\beta$	p	Adjusted for IQ p
<u>Very Preterm</u>					
Conduct problems	0.04	(0.02)	0.21	.04	.03
Hyperactivity/inattention	0.14	(0.04)	0.31	<.001	.005
Inhibitory control problems	0.26	(0.06)	0.43	<.001	<.001
Emotional control problems	0.15	(0.04)	0.35	<.001	.002
Peer problems	0.11	(0.02)	0.37	<.001	.001
<u>Full Term</u>					
Conduct problems	0.15	(0.02)	0.52	<.001	<.001
Hyperactivity/inattention	0.26	(0.04)	0.52	<.001	<.001
Inhibitory control problems	0.38	(0.06)	0.51	<.001	<.001
Emotional control problems	0.27	(0.04)	0.51	<.001	<.001
Peer problems	0.12	(0.02)	0.41	<.001	.001

*df*=82-84 (very preterm group), *d*=100 (full term group)

*Table 6.21 Social Competence Problems at Age 4 Years and Academic Functioning in Very Preterm and Full Term Children at Age 6 Years*

Class Teacher Ratings	B	(SE)	$\beta$	p	Adjusted for IQ p
<u>Very Preterm</u>					
Reading difficulty	0.32	(0.01)	0.26	.01	.73
Spelling difficulty	0.03	(0.01)	0.32	.004	.27
Maths difficulty	0.04	(0.01)	0.37	.001	.08
<u>Full Term</u>					
Reading difficulty	0.04	(0.01)	0.28	.04	.28
Spelling difficulty	0.05	(0.01)	0.39	<.001	.01
Maths difficulty	0.03	(0.01)	0.29	.004	.54

*df*=78 (very preterm group), *df*=97 (full term group)

#### *Summary of Predictive Validity of Social Competence Problems*

The extent to which social competence difficulties in the early childhood period placed children at risk of later school adjustment problems was examined amongst very preterm and full term children. The results of bivariate, univariate and linear regression analyses showed that those very preterm and full term children with more social difficulties during early childhood were at elevated risk of later school compromise, including more behavioural adjustment difficulties and poor academic functioning. However, amongst all study children associations between overall social competence problems at age 4 years and poor academic functioning at age 6 years were largely attenuated by child IQ. In contrast, following statistical control for the effects of IQ, social competence problems amongst both very preterm and full term children remained a significant predictor of later behavioural problems at school. No interactions effects were found between school behavioural and academic outcomes, social competence difficulties and IQ.



## Chapter 7

### Discussion

#### *7.1 Overview of Study*

Children born very preterm are known to be at increased risk of a range of severe neurodevelopmental impairments. However, relatively little is known about their early social capabilities. Research in this area to date has been largely restricted to the use of a narrow range of measures, with few studies providing a comprehensive profile of the social competence of this unique population. In addition, little consideration has been given to identifying infant clinical factors and/or specific socio-familial characteristics that may increase very preterm children's risk of social adjustment difficulties. More critically, there has been virtually no examination of the extent to which social difficulties during the early childhood period may place very preterm children at risk of later behavioural adjustment problems and academic difficulties at school.

Drawing on prospective, longitudinal data from a regional cohort of very preterm children, the present study sought to address these important issues. Briefly, study aims included: the comparison of very preterm and full term children on a broad range of social competence measures; the identification of clinical factors and socio-familial characteristics associated with social competence outcomes amongst children born very preterm; and finally, examination of relations between children's social competence during early childhood and later behavioural adjustment and academic functioning at school. Specifically, a broad, multi-dimensional conceptual framework was used to examine the social competence of a regional cohort of children born very preterm at age corrected 4 years.

Specific strengths of this study were as follows: 1) this study used a prospective longitudinal research design; 2) this study was based on the examination

of a regional cohort of very preterm children born within the Canterbury region therefore avoiding difficulties that may be associated with the study of selective, high risk samples; 3) this study included the examination of a large and demographically representative full term comparison sample; 4) high recruitment and retention rates were achieved; 5) the use of psychological researchers blind to children's perinatal histories; 6) the collection and availability of detailed demographic, family background and observational parenting data; 7) the use of multi-informant report; and 8) an independence of measurement from age 4 to 6 years. Additionally, the current study proposed and applied a broad conceptual framework grounded in developmental theory to the study of social competence. Specifically, four distinct yet interrelated domains of social competence were identified and examined, including emotional regulation, behavioural adjustment, interpersonal social behaviour and social cognition. Major findings and implications of the current study are reviewed below.

### *7.2 Social Competence of Preschoolers Born Very Preterm*

The examination of a range of social competence abilities revealed both similarities and differences in the social functioning of very preterm and full term born children at preschool-age. Specifically, results based on parent report suggest that some very preterm children are at elevated risk of emotional dysregulation, externalising and internalising behaviours, and peer relationship problems by age 4 years. However, while information concerning emotional regulation in the preschool setting was not available, the behavioural adjustment and interpersonal social relationships of very preterm and full term children in this environment were reported to be largely similar. Additionally, no significant group differences were found on measures of social cognition, with similar percentages of very preterm and

full term children passing each theory of mind task (for a summary of the main study findings see Appendix F).

Given the significance of between group differences in capacities for emotional regulation and appropriate behavioural adjustment within the home environment it was somewhat surprising to find that corresponding difficulties were not detected amongst very preterm children in the preschool setting. However, previous research has shown that poor agreement between parents and teachers is not uncommon (Achenbach & Edelbrock, 1987; Briggs-Gowan, Carter, & Schwab-Stone, 1996; Crystal, Ostrander, Chen, & August, 2001) and may be reflective of different views of children and varying expectations and demands across contexts. For example, parents are more likely to observe their children's behaviour across a wide range of settings, as well as during interaction with a more diverse range of adults and children compared to preschool teachers.

It is also possible that preschooler teachers may be less sensitive to the emotional and behavioural difficulties of children born very preterm. This may be the result of a lack of training of early childhood educators in these important areas. Further, previous research has identified a general reluctance amongst teachers to stigmatise preschool-aged children with psychopathological labels (Lutz, Fantuzzo, & McDermott, 2002; Mallory & Kerns, 1988). It is also likely that the social expectations of parents in the home are quite different to those of preschool teachers. For example, preschool settings tend to be characterised by larger numbers of young children and lower adult to child ratios than the home environment. Additionally, the parents of very preterm children may be more sensitive than parents of full term children to any developmental challenges given their children's less optimal start in life.

However, despite such parent and teacher discrepancies, the reliability of the current study findings suggesting that some very preterm children may be characterised by emotional dysregulation and more externalising and internalising behaviours is strengthened by the moderate correlations in children's behaviour across the home and preschool contexts ( $r=0.20-0.37$ ). This is generally consistent with other studies examining the social competencies of children across both the home and school environments (Gizer, Waldman, Abramowitz, Barr, Feng, Wigg et al., 2008; Hill & Hughes, 2007; Runions & Keating, 2007). Further, associations between very preterm birth and compromised emotional regulation and behavioural adjustment during early childhood are strengthened by the significant group differences found in the current study on the more robust, composite measures of emotional dysregulation, externalising and internalising behaviour problems that were reflective of outcomes across both the home and preschool environments. An examination of the distribution of scores amongst the very preterm group revealed much variability across these measures, suggesting that, while some very preterm children experience neither emotional regulation difficulties nor compromised behavioural adjustment, there are a number of very preterm children who are at elevated risk of significant challenges in these domains as early as 4 years of age, especially concerning emotional dysregulation where medium effect sizes were evident.

The current study clearly showed that group differences on the composite measures of emotional dysregulation, externalising and internalising behaviours were robust to statistical control for the effects of socio-economic status. This suggests that between group differences cannot be explained by variations in family socio-economic status, and raises the importance of identifying risk factors of poor social

competence amongst preschoolers born very preterm. A more detailed analysis of the current study findings per domain is provided below

### *7.2.1 Emotional Regulation of Children Born Very Preterm*

Previous research has demonstrated emotional regulation difficulties amongst infants born very preterm (Duffy et al., 1990; Feldman, 2006; Mouradian et al., 2000). For example, in a study comparing the emotional regulation of 17 very preterm (GA<30 weeks and BW<1,000 g), 25 preterm (GA 34-35 weeks and BW 1,700 – 1,850 g) and 29 full term infants at term, day of discharge from the hospital and at age 3 months corrected age using the Behaviour Response Paradigm found that very preterm infants were more negatively reactive (i.e., crying combined with body arching) than both their preterm and full term counterparts ( $p<.01$ ) (Feldman, 2006).

Despite such evidence during infancy, it has been suggested that the emotional regulation capabilities of very preterm and full term children are similar during subsequent developmental periods (Sajaniemi et al., 1998; Sommerfelt et al., 1996). However, it is important to note that both of these studies were solely based on the examination of negative affect. For example, a study comparing 80 very preterm (GA 23-34 weeks) and 80 full term children using the examiner-based Infant Behaviour Record found that all study children displayed similar levels of negative emotional tone at age 2 years corrected (Sajaniemi et al., 1998). While these results suggest that the regulation of negative affect may not be an area of difficulty for children born very preterm during early childhood these findings do little to extend knowledge about potential links between very preterm birth and a broader range of emotional regulation capabilities.

The examination of a more extensive range of emotional regulation capabilities during the early childhood period would likely be more informative. This was

evident in the current study, which was able to demonstrate clear group differences between very preterm and full term children across several measures of emotional regulation (i.e., self-regulation, emotional control and emotional regulation) at age 4 years. Specifically, parents of very preterm children were more likely to report a greater incidence of mood swings, disruptive outbursts, fussiness and upset, as well as less regulated management of excitement. This suggests that while some very preterm children are not experiencing emotional dysregulation and difficulty regulating levels of negative affect during early childhood, there are others who are facing elevated risks of significant emotional regulation problems.

Expanding existing knowledge, the current study also examined the extent to which very preterm and full term preschool-aged children were characterised by emotional regulation difficulties of clinical significance. Specifically, using a composite measure of overall emotional dysregulation and a 90<sup>th</sup> percentile cut-point determined on the score distribution of the control group, results showed that very preterm children were nearly 4 times more likely than full term children to show high levels of emotional dysregulation. This rate is higher than that previously reported by Sommerfelt, et al. (1996) who found that only 2% of both low birth weight (BW<2,000 g) and full term children exhibited clinically significant emotional regulation difficulties at school age (Sommerfelt et al., 1996). However, Sommerfelt's rates may have been underestimated due to the sole examination of levels of negative affect and the inclusion of more mature, higher birth weight children. Further, the higher rates of clinically significant emotional dysregulation reported in the current study may be the result of a more stringent selection criteria and the examination of a broader range of emotional regulation capabilities. Finally, it is also of interest to note that across all measures of emotional regulation examined in the current study the standard deviations of scores amongst children born very

preterm were higher than those of full term children, suggesting a greater amount of variability amongst children born very preterm in their capacity for emotional regulation compared to full term children. Therefore, while a number of very preterm children may be functioning appropriately in these areas at age 4 years the current findings suggest there are also a number of children born very preterm who are not able to demonstrate appropriate emotional regulation.

### *7.2.3 Behavioural Adjustment of Children Born Very Preterm*

It has been well established that older school-aged children born preterm are at an elevated risk of a wide range of behavioural adjustment difficulties. These include elevated rates of ADHD, hyperactivity, inattention, somatic problems, anxiety, over-activity, impulsiveness, distractibility, disorganisation, emotional sensitivity and social isolation reported across the home and/or school environments (Anderson & Doyle, 2003; Botting et al., 1997; Elgen et al., 2002; Foulder-Hughes & Cooke, 2003; Hack et al., 1994; Hoff et al., 2004; Nadeau et al., 2001; Reijneveld et al., 2006; Rickards et al., 1993; Sommerfelt et al., 1996; Szatmari et al., 1990; Taylor et al., 2000b; Tessier et al., 1997). Importantly, the results of the current study demonstrate similar associations even earlier in development of very preterm children. Specifically, parent report showed that some preschoolers born very preterm are at risk of elevated levels of both externalising and internalising behaviours, including inhibitory control problems, hyperactivity/inattention, conduct problems and emotional symptoms. In contrast, while preschool teachers also noted high rates of behavioural adjustment problems amongst very preterm children these group differences were non-significant, with the exception of more inhibitory control problems amongst the very preterm group.

The results of the current study showing links between very preterm birth and elevated risks of inattention/hyperactivity, conduct behaviour problems and difficulties with inhibitory control are generally consistent with other preschool-aged studies (Assel et al., 2002; Delobel-Ayoub et al., 2006; Sajaniemi et al., 1998). For example, a study comparing the behavioural adjustment of 1,228 very preterm (GA 22-32 weeks) and 447 full term children using the parent Strengths and Difficulties Questionnaire found that very preterm children were characterised by more hyperactivity and conduct problems at age 3 years (Delobel-Ayoub et al., 2006). Interestingly, while studies of older school-aged children born preterm suggest that inattention and/or hyperactivity may be the primary areas of concern (Botting et al., 1997; Elgen et al., 2002; Foulder-Hughes & Cooke, 2003; Hille et al., 2001; Shum et al., 2008; Szatmari et al., 1990) the results of the current study suggest that during early childhood some very preterm children may be at elevated risk of a wider range of externalising behaviours. It may be that the growing behavioural demands of school contribute to increasingly evident levels of inattention. Alternatively, hyperactivity and/or attention difficulties of children born very preterm may increase across developmental periods, more so than other behavioural problems. Closer inspection of the changing nature of the behavioural adjustment of very preterm children across the early and middle childhood periods will be necessary.

While internalising behaviours have been examined to a much lesser extent amongst preterm samples, there has been some evidence to suggest that that school children born very preterm may also be at risk of more somatic problems and elevated levels of anxiety (Anderson & Doyle, 2003; Reijneveld et al., 2006; Sommerfelt et al., 1996). However, much less is known about the extent to which very preterm children may be at risk of internalising behaviours prior to the transition to school as previous preschool-aged studies have tended to focus on externalising



aspects of behavioural adjustment. However, there are a few studies worthy of mention that suggest some children born preterm may be characterised by internalising behaviours prior to school age, at least within the home environment (Delobel-Ayoub et al., 2006; Weisglas-Kuperus et al., 1993). For example, a longitudinal study comparing the internalising behaviours of 114 VLBW (GA<36 weeks and BW<1,500 g) and 192 full term children using the parent Child Behavior Checklist found that VLBW preschoolers had more somatic problems, emotional difficulties and were more likely to have depression problems at age 3.5 years (Weisglas-Kuperus et al., 1993). The findings of the current study add further support for the presence and identification of internalising behaviours amongst some very preterm children prior to school entry. Further, these results strengthen existing evidence of associations between very preterm birth and both externalising and internalising behaviours by addressing a number of methodological limitations inherent in previous studies, including the use of age correction for the extent of prematurity, and the examination of relatively large, regional and representative study samples matched for age and gender.

Findings from this study also showed that by age 4 years very preterm children were already 1.5 times more likely than full term children to exhibit externalising and/or internalising behaviour problems of clinical significance. These rates are similar to previous reports of children born very preterm being 2 times more likely to exhibit clinically significant levels of hyperactivity, and 1.7 times more likely to present with conduct problems or emotional symptoms of clinical significance at age 3 years (Delobel-Ayoub et al., 2006). Of further concern is evidence that these rates appear to increase with age. For example, children born preterm (GA <32 weeks) are 4.2 times more likely than full term children to meet the clinical criteria for ADHD at age 7-8 years (Foulder-Hughes & Cooke, 2003), with LBW (BW<2,000 g)

children being 8.2 times more likely to exhibit clinically significant behaviour problems at age 11 years (Elgen et al., 2002), while adolescents born preterm (GA <29 weeks) have been found to be 7 times more likely to exhibit clinically significant levels of hyperactivity (Gardner et al., 2004). Increasing rates of externalising behaviour problems with age may arise due to a number of reasons. For example, across developmental periods the attentional and behavioural difficulties of children born very preterm may become increasingly apparent as they encounter the demands of school life and perhaps increasing parental expectations concerning the definition of acceptable behaviour. A further possibility is that the behavioural problems of very preterm children actually increase over time. Further interpretation of these figures is complicated by variations in the gestational age and birth weight criteria of preterm samples across studies.

In sum, the findings of the current study suggest that by age 4 years some children born very preterm are already at increased risk of a range of both externalising and internalising behavioural difficulties which are clearly evident in the home environment. There is also some evidence to suggest that these behavioural difficulties are beginning to emerge within the preschool environment.

#### *7.2.4 Interpersonal Social Behaviour of Children Born Very Preterm*

Previous research suggests associations between prematurity and poor social interactive behaviour during infancy, middle childhood and beyond (Beek et al., 1994; Brown et al., 2003; Crnic et al., 1983; Gardner et al., 2004; Grunau et al., 2004; Hack et al., 1994; Hoff et al., 2004; Indredavik et al., 2005; Landry, Smith, Miller-Loncar, & Swank, 1997b; Reijneveld et al., 2006). These include poor social skills, fewer social initiations, greater social problems, elevated rates of social rejection and more peer problems. However, the results from this part of the current

study did not fully support the presence of interpersonal social difficulties amongst preschoolers born very preterm. Specifically, parent report showed that children born very preterm were significantly less likely than full term children to exhibit play behaviours conducive to successful peer interaction (i.e., comforting others, helping to settle conflicts and sharing) and to have more peer relationship problems (i.e., solitary play, being picked on or bullied, and less well liked by their peers), with levels of social problems in the home environment consistently elevated for children born very preterm. However, very preterm and full term children displayed similar levels of disruptive and withdrawn play behaviours at home. This included similar levels of aggression, whining, and tattling, with very preterm and full term children equally likely to be ignored, confused or withdrawn during play within the home setting.

Similarities in the interpersonal social behaviour of very preterm and full term children were also found within the preschool environment. Specifically, preschool teachers did not report any significant group differences concerning early play behaviours and peer relationships. While rates of social behaviour problems were again typically elevated amongst very preterm children, levels of variability evident in the standard deviations across all preschool measures were similar for both groups. Furthermore, the comparison of children's abilities to successfully interact with their peers across the home and preschool settings using a more robust, composite measure of interpersonal social functioning did not reveal significant between group differences. It was therefore concluded that during the early childhood years the social relations of very preterm and full term children across settings are largely similar.

These findings are generally consistent with existing preschool studies showing that very preterm and full term children are characterised by similar levels of social

responsiveness, social initiating, social functioning and social problems (Assel et al., 2002; Hemgren & Persson, 2002; Theunissen et al., 2001). For example, a study comparing 180 preterm ( $GA \leq 36$  weeks and  $BW \leq 1,600$  g) and 112 full term children at age 4 years using the parent Child Behaviour Checklist (CBCL) and an observation of parent-child interaction found that both groups had similar levels of engagement with their mother's during daily activities and toy play, and were equally likely to be characterised by immaturity or difficulty when interacting with their peers (Assel et al., 2002). However, there has been some evidence to the contrary. A study by Chen et al. (2004) compared 238 VLBW ( $BW < 1,500$  g) and 91 full term children using the parent Chinese Child Developmental Inventory and found links between birth status and poor social development by age 3 years (Chen et al., 2004). Specifically, VLBW children tended to be characterised by lower levels of play with other children and were less helpful during social interactions than their full term peers.

Despite similar interpersonal social behaviours across both groups, the current study found that preschoolers born very preterm were 1.5 times more likely than full term children to exhibit interpersonal social problems of clinical significance. This rate is lower than that reported by Chen et al. (2004) who found that VLBW children were approximately 3.5 times more likely to exhibit clinically significant social difficulties at corrected age 3 years, while school children born preterm have been estimated to have a 2.6-3.5 fold risk of clinically significant social problems at age 5 years (Reijneveld et al., 2006; Sommerfelt et al., 1996). Together, this evidence suggests that while the majority of preschoolers born very preterm may experience a similar quality of peer interactions to full term children, a small number of these children may display significant and clinically relevant interpersonal social difficulties before school age.

The elevated rates of clinically significant interpersonal social difficulties found amongst preschool-aged children in the current study combined with reports of increased risks for a range of social difficulties during middle childhood, including poor social skills (Brown et al., 2003; Hack et al., 1994; Hoff et al., 2004), more social problems (Grunau et al., 2004; Indredavik et al., 2005; Reijneveld et al., 2006), greater levels of peer rejection (Gardner et al., 2004; Rickards et al., 2001) and less social competence (Grunau et al., 2004) suggest that links between very preterm birth and poor social functioning are unlikely to be attenuated over time. Rather, the social difficulties of preschoolers born very preterm may become increasingly apparent in subsequent years. Further, social difficulties may be especially difficult to detect amongst preschool-aged children for a number of reasons. The early childhood years represent a developmental period in which many children will experience an increasing need for independent social functioning as they enter preschool and/or day care environments. Therefore, many preschool-aged children will be relative new comers to the complexities of successful independent social functioning, free from scaffolding support from their caregivers. This relative inexperience across children may hinder the identification of differences in the early social behaviours of very preterm and full term children. The detection of early interpersonal social difficulties amongst children born very preterm may have also been affected by the use of measures that may be insensitive to the detection of likely subtle, yet potentially important, social relationship difficulties. Therefore, perhaps largely undetectable social difficulties during early childhood may become increasingly evident amongst school children born very preterm as they begin to experience increasing social demands at school, where they may be expected by teachers to display appropriate behavioural, emotional and social behaviour whilst

interacting with large groups of children and attempting to concentrate on specific academic tasks.

Together, these findings suggest that a small number of very preterm children may be characterised by significant social difficulties across the home and preschool environments. Despite few significant group differences overall, these findings warrant further attention in light of the difficulties that may be associated with the identification of likely subtle social difficulties during early childhood, and the importance of identifying very preterm children who are at increased risk of later social behaviour problems prior to school entry. This may provide an important step towards limiting the adverse consequences of peer relationship problems, including academic and learning difficulties, conduct problems, delinquency and criminality (Coie & Krehbiel, 1984; Miller-Johnson, Coie, Maumary-Gremaud, Lochman, & Terry, 1999; Moffitt, 1993).

#### *7.2.5 Social Cognition of Children Born Very Preterm*

Whilst not previously examined within preterm samples, findings in this part of the current study suggest that very preterm and full term children were characterised by similar levels of social cognitive understanding based on their performance on a battery of false belief tasks at age 4 years. Specifically, while a smaller percentage of very preterm children passed each ToM task, group differences were not statistically significant. Moreover, all study children performed similarly on the more robust, composite measure of social cognition based on children's combined performance across the 'Sally-Ann', 'Smarties' and 'Fishing Story' tasks. However, it is important to note that very preterm children did tend to be characterised by lower pass rates than full term children. It is possible that the examination of theory of mind when all study children were 2 weeks either side of their fourth birthday may

have been too early to reveal significant group differences. This suggests that it may be important for future studies of very preterm children to examine the on-going development of this important and fundamental aspect of early social competence. Nonetheless, these findings make an important and unique contribution to the preterm literature as no previous efforts appear to have been made to examine the possible impacts of very preterm birth upon children's development of theory of mind.

Importantly, these findings have several implications for developmental theorists concerned with social cognition. For example, as noted in Chapter 2, the mainstream theory of mind literature remains somewhat conflicted about the age at which children acquire their capacities for 'mind-reading', with proposed ages of onset ranging from 3 years (Astington & Gopnik, 1991; Chandler, Fitz & Hala, 1989; Flavell, Flavell, Green & Moses, 1990; Lewis & Osbourne, 1990) to 5 years (Ruffman, Olson, Ash, Keenan, 1993; Russell, Mauthner, Sharpe & Tidwell, 1991). Our findings clearly showed that high percentages of both very preterm and full term children had yet to fully develop theory of mind by age 4 years. Specifically, on average only 25% of very preterm and 31% of full term preschoolers were able to pass each ToM task. With the exception of the Sally-Ann task, these pass rates are lower than previous reports of at least 50% of typically developing children passing similar false belief tasks during the preschool years (Baron-Cohen et al., 1985; Carlson, Mandell & Williams, 2004; Hughes et al., 2000; Hughes et al., 1998; Muller et al., 2005). While such rates have at times been based on unrepresentative control groups (i.e., middle class, college educated, two parent families), current study findings suggest that the majority of all study children performed at below chance levels at age 4 years regardless of birth status. Subsequently, these findings do not support those advocating an early onset of theory of mind understanding, but rather

suggest that these capabilities may emerge at a later point in children's social development.

These findings also bring into question the extent to which the ToM tasks applied in the current study are reflective of the same underlying construct. Specifically, while approximately half of very preterm and full term children were able to correctly pass the 'Sally-Ann' unexpected transfer task, three quarters of children in both groups were unable to pass the 'Fishing Story', and approximately 90% of very preterm and full term children failed the 'Smarties' unexpected contents task. Such large discrepancies across tasks purported to represent the same construct are of particular concern, as these tasks are commonly used independently to test children's social cognitive understanding. Despite similar variations evident in the mainstream literature (Hughes et al., 2000), and concerns about the reduction of an unfolding mentalistic conception into a simple pass or fail variable (Tager-Flusberg, 2001), as well as the stark contrast of false belief tasks to the ways in which real life social dilemmas are presented (Klin, 2000), the validity and reliability of ToM tasks have rarely been examined. However, evidence to date suggests that the reliability of false belief tests is poor to moderate (Charman & Campbell, 1997; Mayes, Klin, Tercyak, Cicchetti, & Cohen, 1996). For example, a study examining the theory of mind of 23 children aged from 36 to 71 months using three false belief tasks presented in randomly counterbalanced order found that the test-retest reliability of false belief tasks was poor, with some children failing to correctly answer questions they had previously passed 2 weeks earlier (Mayes et al., 1996).

Despite reliability concerns, it can likely be concluded with some confidence that children who fail several false belief tasks are reliably failing and that children who pass several tasks are reliably passing. However, the interpretation of children's level of understanding becomes more problematic when they demonstrate



intermediate levels of success (Charman & Campbell, 1997). This is evident in the current study, with 49% of very preterm and 56% of full term children demonstrating variable performances across the three false belief tasks. This variability combined with low pass rates across both groups supports the notion that theory of mind is not an all-or-none capability but rather that children may have a partial grasp of the required concepts (Charman & Campbell, 1997). Clearly, there is a need for further investigation into the psychometric properties and validity of traditional false belief tasks amongst both typical and atypical populations (Charman & Campbell, 1997; Fabricius & Khalil, 2003; Mayes et al., 1996).

The apparent robustness of the early theory of mind development amongst preschoolers born very preterm is somewhat surprising in light of associated risks for impairment in developmental domains considered to be important to theory of mind understanding, including language (Astington & Jenkins, 1999; Cheung, 2006; Dunn, Brown, Slomkowski, & Tesla, 1991; Milligan, Astington, & Dack, 2007; Ruffman et al., 2002; Symons, Peterson, Slaughter, Roche, & Doyle, 2005), executive functions (Carlson et al., 2004; Lewis, Huang, & Rooksby, 2006; Moses & Sabbagh, 2007), and a number of neurological areas (Kobayashi, 2007; Kobayashi, Glover, & Temple, 2007; Liu, 2006; Ohnishi, Moriguchi, & Matsuda, 2004). For example, a study by McAlister and Peterson (2006) examined 124 typically developing children aged 3 to 5 years and found that both language and executive functioning skills including forward planning, inhibitory control and task switching were significant independent contributors to children's performance on a composite measure of theory of mind (McAlister & Peterson, 2006). Inhibitory control and working memory in particular may be related to children's development of theory of mind as children need to be able to hold conflicting alternatives in their mind and must also inhibit thoughts pertaining to their own knowledge in order to correctly interpret

another person's understanding. Therefore, while very preterm children are known to be at increased risk of a range of executive functioning deficits (Anderson & Doyle, 2004; Clark, 2008; Edgin, Inder, Anderson, Hood, Clark & Woodward, 2008; Taylor, Minich, Bangert, Filipek, & Hack, 2004; Woodward, Edgin, Thompson, & Inder, 2005) it was somewhat unexpected that similar levels of theory of mind were evident across both groups. Further research is clearly needed to disentangle the complex relationships between language, executive functioning, neurological development and theory of mind.

### *Summary of Social Competence*

The first section of the current study comparing very preterm and full term children's emotional, behavioural, interpersonal and social cognitive development at age 4 years clearly showed that children born very preterm are at an elevated risk of externalising and internalising behavioural adjustment problems, as well as particular difficulty with emotional regulation. Further, between group differences were robust to statistical control for the selection effects of socio-economic status, with wide variability in the extent to which very preterm children were characterised by emotional dysregulation and behavioural difficulties. In contrast, similarities were evident concerning the interpersonal social behaviours and social cognition of very preterm and full term children. However, there was subtle evidence of very preterm children performing less well in both of these areas which suggests that further research examining links between very preterm birth and social relations and social cognition may be important during later developmental periods. Perhaps most importantly, the findings of the current study highlight the value of adopting a broad conceptual approach to the examination of social competence, as studies examining a single domain may underestimate the extent to which very preterm birth is associated

with increased risk of social difficulties. By utilising a broader conceptual framework, the current study offers a more in-depth insight into the early social capabilities of very preterm children and reveals that while some children may be performing as well as their full term peers others born very preterm are characterised by significant emotional regulation difficulties and behavioural adjustment problems. These findings raise an important question concerning the identification of risk factors associated with poor social competence amongst very preterm children prior to school age.

### *7.3 Predictors of Social Competence Problems in Children Born Very Preterm*

Adopting an integrative developmental approach, the second major issue addressed in the current study concerned the identification of specific infant clinical factors and socio-familial characteristics that may place very preterm children at elevated risk of significant social difficulties during early childhood. The importance of this question was reinforced by the considerable variability in the social competence of very preterm preschoolers (see Figure 7.3), making it clear that some very preterm children tend to fare less well than others by age 4 years.

The results of this analysis (Chapter 6) showed that amongst very preterm children similar infant clinical and socio-familial risk factors were associated with emotional dysregulation and externalising behaviour problems. Specifically, male gender, indomethacin, and high levels of maternal anxiety during the first 4 years of life predicted both emotional dysregulation and externalising behaviour problems. In contrast, increased risk for internalising behaviour problems were predicted only by low infant birth weight with none of the socio-familial characteristics examined contributing to later outcome. The infant clinical and socio-familial risk factors

associated with later social outcomes are now discussed in relation to existing preterm and mainstream research.

Links found in the current study between male gender and an increased risk of externalising behaviour problems are consistent with previous studies documenting higher rates of externalising behaviours amongst males in clinically-referred and community samples during the preschool years and beyond (Kann & Hanna, 2000; Moffitt, Caspi, Rutter, & Silva, 2001; Romano, Tremblay, Vitaro, Zoccolillo, & Pagani, 2005). Specifically, male preschool-aged children have been found to be at elevated risk of externalising behaviour, including physical aggression (Chaplin, Cole, & Zahn-Waxler, 2005; Keenan & Shaw, 1997), oppositional behaviour (Sanson & Prior, 1999) and tantrums (Bhatia, Dhar, Singhal, Nigam, Malik & Mullick, 1990), as well as a greater likelihood of receiving a diagnosis of conduct disorder or oppositional defiant disorder, than female preschoolers (Hinshaw & Anderson, 1996). As discussed in the Introduction, similar links between male gender and increased risk for a range of behavioural problems have been reported in older preterm samples, including hyperactivity, ADHD, aggression and delinquency (Elgen et al., 2002; Grunau et al., 2004; Taylor et al., 2000b; Tessier et al., 1997). While it is important to note that the ratios of male to female participants in some of these studies were not evenly distributed, the findings of the current study suggest that some male children born very preterm may be at elevated risk of externalising behaviour problems and that these difficulties may be evident prior to school entry.

Further, the findings of the current study show that males born very preterm may also be at an increased risk of emotional dysregulation during the early childhood period. While little effort has been made to examine the role of gender in the emotional regulation of children born very preterm, within the mainstream literature links have been established between emotional dysregulation and

concurrent externalising behaviour problems (Calkins & Dedmon, 2000; Eisenberg, Cumberland, Spinrad, Fabes, Shepard & Reiser, 2001; Eisenberg, Guthrie, Fabes, Shepard, Murphy et al., 2000). For example, a study of 99 children at age 2 years using a number of tasks designed to elicit multiple levels of emotional regulation found that those children with clinically significant externalising behaviour problems were also characterised by more physical venting, tantrums and less putative emotional regulatory behaviours than control children (Calkins & Dedmon, 2000). While poor emotional regulation is not sufficient on its own to account for the manifestation of externalising behaviour problems (Hill, Degnan, Calkins, & Keane, 2006), the findings of the current study suggest that the emotional and behavioural risks associated with being born male may be somewhat similar amongst very preterm and full term children.

There are a number of reasons why males born very preterm may be at elevated risk of externalising behaviour problems and emotional dysregulation during early childhood. Gender differences may arise from socialisation processes in which females are encouraged to channel their problem behaviours into a more acceptable, sex-stereotyped form (i.e., shy, withdrawn) (Chaplin, Cole & Zahn-Waxler, 2005; Keenan & Shaw, 2003; Underwood, 2003). Consequently, parents and preschool teachers may be less likely to notice the behavioural and emotional regulation difficulties of females born very preterm. An alternative explanation for the elevated risks of externalising behaviour and emotional dysregulation amongst males born very preterm during the preschool years may arise from gender differences in development. Specifically, it appears that the biological, physical, verbal, social, emotional and self-regulatory capabilities of females mature at a faster rate than males with differences in maturation increasing with age (Eme, 1992; Keenan & Shaw, 2003). These maturational advances noted amongst normative samples may

provide females born very preterm with better adaptive skills than male counterparts to manage externalising behaviour problems and difficulties with emotional regulation, as well as meeting the likely increasing behavioural expectations of parents and teachers.

In addition, it is likely that the gender differences found amongst very preterm children in the current study also reflect differing aetiology to those observed in normative samples. Specifically, males born very preterm are likely to be at greater risk of clinical compromise than their females counterparts (Bhaumik et al., 2004; Elsmen et al., 2004; Lavoie et al., 1998; Tu et al., 2007; Wood, Costeloe, Hennessy, Marlow, & Wilkinson, 2003). These excess vulnerabilities to insult likely provide additional avenues via which the behavioural adjustment and emotional regulation of males, rather than females, born very preterm may be compromised. For example, elevated risks for social compromise found amongst very preterm males may be the result of hypoxic-ischemic brain insult, which is triggered by the frequent respiratory problems experienced by very preterm newborns and is a prominent contributor to the most common brain insult in the preterm infant, intracranial hemorrhage (Lavoie et al., 1998).

Additionally, higher rates of clinical compromise amongst very preterm males at birth will likely be associated with a range of medical interventions necessary to sustain the life of the infant. Subsequently, compared to female counterparts newborn males born very preterm may experience longer periods of maternal separation which may cause apoptosis (programmed cell death) in the immature brain, and the central nervous system of male very preterm infants may encounter greater exposure to painful medical procedures. This may result in males born very preterm producing excessive excitatory amino acid which may damage developing neurons (Geva & Feldman, 2008), and experiencing elevated levels of neonatal stress

(Tu et al., 2007). Such neurological and central nervous system insult may contribute to disturbed reactivity, inattention and regulatory difficulties (Chudasama et al., 2003), as abilities to maintain physiological homeostasis may be compromised. It is also likely that developmental delays and elevated clinical compromise combine with socialisation efforts to place very preterm males at elevated risks for externalising behaviour and emotional dysregulation during the preschool period. While further research will be required to better understand these complexities, the current study shows that male gender is associated with increased risk for social competence difficulties amongst preschool-aged children born very preterm.

In addition to male gender, increased risks of emotional dysregulation and externalising behaviour problems were found amongst very preterm children who had received indomethacin around the time of birth. Indomethacin is a powerful vasoactive drug (Evans, Levene, & Archer, 1987), which is commonly used for the non-invasive closure of symptomatic patent ductus arteriosus (Gersony, Peckham, Ellison, Miettinen, & Nadas, 1983; Sekar & Corff, 2008). Specifically, the ductus arteriosus is an artery that diverts blood away from the non-functioning lungs of the foetus, which closes in 90% of healthy newborns within 48 hours after birth (Austin, 1994; Gentile et al., 1981). However, in very preterm neonates closure of this duct may be delayed and is referred to as patent ductus arteriosus (PDA). This condition may lead to increased blood flow to the lungs, effectively ‘flooding’ the lungs and adding to the newborn’s respiratory difficulties. Consequently, as a preventative measure it has been recommended that all babies born weighing less than 1,000 grams should receive indomethacin (Mahoney, Carnero, Brett, Heymann, & Clyman, 1982).

Despite the obvious advantages of duct closure, it is important to note that this pharmacological intervention has been associated with a number of adverse

physiological and neurological side effects. These include elevated rates of renal dysfunction, necrotizing enterocolitis, periventricular leukomalacia (Amin, Sinkin, & Glantz, 2007; Herrera, Holberton, & Davis, 2008), possible ischemic brain injury (Edwards, Wyatt, Richardson, & Potter, 1990; Laudignon, Chemtob, Bard, & Aranda, 1988) and increased oxygen requirements (Yaseen, Alumram, Ali, Rustrum, Danvich & Faraidy, 1997). Indomethacin has also been associated with reduced hippocampal volumes (Thompson, Wood, Doyle, Warfield, Lodygensky, Anderson et al., 2008) and decreases in blood flow to the intestines, kidneys and brain (Austin, 1994; Ohlsson, Walia, & Shah, 2008). Of particular concern are associations between indomethacin and rapid reductions in the cerebral blood flow of preterm newborns (Austin, 1994; Cowan, 1986; Edwards, Wyatt, Richardson & Potter et al., 1990; Evans, Levene & Archer, 1987; Lundell, Sonesson, & Cotton, 1986), with estimates suggesting that these reductions may last for up to 20 hours or longer (Evans et al., 1987; Rennie, Doyle, & Cooke, 1986; Yaffe, Friedman, Rogers, Lang, Ragni & Saccar, 1980). Therefore, the receipt of indomethacin may be associated with a wide range of potentially severe and adverse physiological influences, which may in turn have detrimental effects upon very preterm children's subsequent capacities for emotional regulation and behavioural adjustment.

However, little is known about the long-term developmental consequences associated with indomethacin, with results to date being inconsistent. For example, a recent meta-analysis (Fowlie & Davis, 2003) of 19 trials examining the effects of indomethacin found that only three of these studies had examined the potential implications for cognitive outcomes. Specifically, using the Bayley Infant Scales of Development or the Wechsler Preschool and Primary Scale of Intelligence – Revised, each study reported no significant difference between indomethacin exposed and non-exposed preterm infants and preschoolers with respect to levels of



severe developmental delay (i.e., MDI score <68 or WPPSI-R IQ score <70) (Bandstra, Montalvo, & Goldberg, 1988; Ment, Oh, Ehrenkranz, & Philip, 1994; Schmidt, Davis, Moddemann, Ohlsson, Roberts, Saigal et al., 2001). Further, a study by Thompson, et al. (2008) comparing 184 preterm (GA<30 weeks or BW<1,250 g) and 32 full term children using the Bayley Scales of Infant Development found no significant associations between indomethacin and poor cognitive functioning at age 2 years (Thompson, Wood, Doyle, Warfield, Lodygensky, Anderson et al., 2008).

While indomethacin has been associated with improved cognitive test scores for preterm boys at age 8 years (Ment, Peterson, Meltzer, Vohr, Allan, Katz et al., 2006; Ment, Vonr, & Makuch, 2004), a general lack of longitudinal research in this area combined with the fact that little is known about the effects of this pharmacological agent on the developing brain (Ment et al., 2006) has led to calls for the cautious use of indomethacin (Amin, Sinkin & Glantz, 2007; Austin, 1994; Perlman, 1998). Associations found in the current study between indomethacin and later emotional dysregulation and externalising behaviour are complex and likely multi-factorial in nature. While the evidence found in the current study offers further support for the cautious use of indomethacin, there is a clear need for more extensive research investigating the long-term developmental outcomes associated with the receipt of indomethacin before any causal links can be assumed.

While no other infant clinical factors were found to be associated with increased risk of emotional dysregulation or externalising behaviour problems amongst preschooler's born very preterm, it is important to note a few absent associations. For example, in the current study the extent and severity of white and grey matter abnormalities on term MRI was not related to later emotional regulation, externalising or internalising behaviour problems. However, it will be important to

continue the pursuit of links between detectable neurological injury and impairments in social functioning, with recent evidence from developmental neuroscience suggesting that the regions of the brain associated with emotional regulation include the prefrontal cortex, the anterior cingulate cortex and the amygdala (Beuregard, Levesque, & Paquette, 2004). Further, links were not found between emotional dysregulation, externalising behaviour problems and gestational age or birth weight despite evidence that these characteristics may be associated with adverse developmental outcome (Hack et al., 1994; Sajaniemi et al., 1998). However, these results are similar to others reporting a lack of association between decreasing gestational age, lower birth weight and later social adjustment problems (Anderson & Doyle, 2003; Hoff et al., 2004; Reijneveld et al., 2006). It would therefore appear that proposed links between decreasing gestational age and/or birth weight and poor developmental outcomes may not be as clear-cut as initially thought. This is likely due to the great variability in clinical presentation typically evident amongst very preterm newborns despite age and size at birth.

Over and above the influence of infant clinical status, the current study also found risks of emotional dysregulation and externalising behaviour problems amongst children born very preterm were further elevated by high levels of maternal anxiety across the first four years of life. While mainstream studies have predominantly focused on links between maternal depression and adverse child development (Ilardi, 2007), there is some evidence that maternal anxiety may also place children at increased risk of compromised social development, including poor orientation during infancy (Brouwers, van Baar, & Pop, 2001), increased aggression during early childhood (Bernstein, 2006) and greater risk of anxiety disorder and depressive symptoms during adolescence (Schreier, Wittchen, Höfler, & Lieb, 2008; Spence, Najman, Bor, O'Callaghan, & Williams, 2002).

Similar associations have been reported in the preterm literature. For example, a study by Gray et al. (2004) assessed 869 preterm (GA<37 weeks and BW<2,500 g) children at 3, 5, and 8 years of age using the maternal version of the General Health Questionnaire (Goldberg & Williams, 1988) and the parent Child Behaviour Checklist (Gray et al., 2004). Results showed that preterm children whose mothers were experiencing high levels of psychological distress at 40 weeks were significantly more likely to be characterised by clinically significant behaviour problems across all time points. Further, a study by Muller-Nix, et al. (2004) compared 47 very preterm (GA<34 weeks) and 25 full term infants at 6 and 18 months corrected using the Perinatal Posttraumatic Stress Disorder Questionnaire (Quinnell & Hynan, 1999) and a 10 minute mother-child play interaction (Muller-Nix, Forcada-Guex, Pierrehumbert, Jaunin, Borghini & Ansermet, 2004). Results showed that at age 18 months those very preterm infants whose mothers were experiencing high levels of anxiety in the perinatal period were significantly more compliant than full term peers, while low levels of maternal anxiety were associated with more passivity amongst very preterm infants. These findings suggest associations between maternal anxiety and children's social competence.

There are several mechanisms via which high maternal anxiety may be detrimental to children's emotional and behaviour development. These include the exposure to a stressful environment, the consequence of a genetic predisposition (Goodman & Gotlib, 1999) and on-going disturbances in the quality of mother-child relations (Muller-Nix et al., 2004; Schmucker, Brisch, Kohntop, Betzler, Osterle, Pohandt et al., 2005; Singer, Fulton, Kirchner et al., 2007; Whaley, Pinto, & Sigman, 1999). Specifically, parents experiencing elevated levels of anxiety are likely to exhibit high levels of negative parenting behaviours, including criticism, negativity, and controlling behaviours, along with low levels of sensitivity, warmth and

autonomy (Muller-Nix et al., 2004; Whaley et al., 1999). It is also important to recognise the bi-directional nature of the parent-child relationship. For example, children with anxious parents have been found to be seven times more likely than children of non-anxious parents to have an anxiety disorder (Turner, Beidel, & Epstein, 1991). This may be due to genetic contributions, maternal modelling of anxious behaviour and attitudes (i.e. pessimism), and altered parenting styles as discussed in Chapter 4. Further, a negative mother-child interactional cycle may evolve as increased risks of negative parenting may further place a child at risk of behavioural and emotional regulation difficulties, with these difficulties in turn contributing to additional anxiety for the mother (Stevenson, Blackburn, & Pharoah, 1999). Likewise, the non-anxious mother of a child characterised by conduct problems, hyperactivity and poor emotional regulation may subsequently be placed at elevated risk for anxiety compared to the mother of a child who is easier to manage (Last, Hersen, Kazdin, Orvaschel, & Perrin, 1991). Clearly, the pathways implicated between maternal anxiety and compromises in children's social development are complex. There are undoubtedly many other possible reasons for the relationship between maternal anxiety and externalising behaviours and emotional dysregulation amongst very preterm children that warrant further examination.

An important point to consider is that while associations were found between observed negative parenting behaviour and emotional dysregulation these effects were largely attenuated by high levels of maternal anxiety. This suggests that intervention efforts directed towards the optimisation of positive parenting behaviour may be wise to also address maternal anxiety levels. As mentioned in Chapter 3, this may be particularly important given that women experiencing preterm birth have been shown to be at increased risk for high levels of anxiety, mood and fatigue

(Assel et al., 2002; Davis et al., 2003; Garel et al., 2006; Lohr et al., 2000; Muller-Nix et al., 2004; Singer, Fulton, Davillier et al., 2007; Singer, Salvator, Guo, Collin, Lillen et al., 1999; Zelkowitz et al., 2007), as well as evidence that very preterm infants may be especially susceptible to the adverse effects of negative parenting behaviour due to their neurological vulnerability (Landry, Smith, & Swank, 2003).

In the current study, emotional dysregulation amongst very preterm children was also associated with low socio-economic status. As discussed in the Introduction, socio-economic status has long been recognised as a mediator of developmental outcome amongst normative samples. Importantly, this finding reflects similar evidence in the preterm literature. For example, a study by Malatesta, et al. (1989) examined 18 very preterm infants (GA<30 weeks & BW<1,000 g) at ages 2.5, 5 and 7.5 months using a brief parent separation – reunion paradigm (Malatesta et al., 1989). Infants' behavioural reactions were coded using the Maximally Discriminative Facial Coding System (Izard, 1979). Results showed that very preterm infants from low socio-economic status families displayed more negative facial affect than their higher socio-economic status counterparts. The findings of the current study suggest the presence of a similar link between low socio-economic status and emotional dysregulation amongst those born very preterm during the early childhood period.

In contrast to the predictive models of emotional dysregulation and externalising behaviour problems, the current study found that internalising behaviour problems were predicted only by low birth weight. No other infant clinical factors or socio-familial characteristics examined were linked to increased risks for internalising behaviour problems amongst preschoolers born very preterm. As previously mentioned, low birth weight has been associated with a range of adverse neuro-developmental outcomes across developmental periods. These

include more negative affect and poor regulation of arousal during infancy (Feldman, 2006), inattention during early childhood (Sajaniemi et al., 1998), and elevated rates of neuro-sensory disorder, cognitive impairment, inattention, aggression, withdrawal, hyperactivity, learning difficulties and social problems during middle childhood (Anderson & Doyle, 2003; Hack et al., 1994; Taylor et al., 2000a). Further, low birth weight has been associated with elevated risks for inattention, delinquency, aggression, hyperactivity, generalised anxiety disorder and depression during adolescence (Botting et al., 1997; Grunau et al., 2004; Indredavik et al., 2005; Taylor et al., 2000b). For example, a longitudinal study by Bohnert, et al. (2008) examined a random sample of 823 children at ages 6, 11, and 17 years using the parent and teacher Child Behavior Checklist (Bohnert & Breslau, 2008). Using standard cut points based on normed data, the results showed that those children with low birth weight had modest excesses of persistent externalising (OR=1.53) and internalising (OR=1.28) behaviour problems throughout the school years (Bohnert & Breslau, 2008). While Bohnert used a generous low birth weight criteria ( $BW \leq 1,500$  g), the findings of the current study suggest that similar associations between low birth weight and internalising behaviour problems are evident amongst very preterm preschoolers. However, these associations may not be the result of birth weight per se but rather may be due to associated clinical and/or socio-familial risks that were not examined in the current study.

#### *7.4 Influence of Preschool Social Competence on Later School Functioning*

The final section of this study aimed to examine the extent to which children characterised by higher levels of social difficulties during the early childhood period were placed at elevated risk of behavioural maladjustment and poor academic functioning at school. Due to questions concerning the extent to which similar

associations may be evident across groups, both very preterm and full term children were included in this section of the analysis. It was hypothesised that across both groups, children characterised by more overall social difficulties at age 4 years would be at elevated risk of poor school outcomes at age 6 years. This hypothesis was supported, with less socially competent very preterm and full term preschoolers characterised by elevated rates of hyperactivity/inattention, inhibitory control problems, conduct problems, emotional control difficulties and peer relationship problems at school. These children were also at increased risk for below average or delayed performance in the subject areas of reading, spelling, math and language comprehension. These results suggest the adverse effects of poor social competence during the early childhood years similarly impact upon the later school functioning of very preterm and full term children.

As discussed in Chapter 1, these findings are consistent with reports in the mainstream literature showing links between social competence difficulties during early childhood and increased rates of later difficulties at school, including academic failure, low cognitive ability, poor achievement scores, school absences, conduct problems, school dropout and delinquency (Bub, McCartney, & Willett, 2007; Kellam, Werthamer-Larsson, Dolan, Brown, Mayer & Rebok, 1991; Moffitt, 1993; Patterson, Reid, & Dishion, 1992; Tremblay, Vitaro, Bertrand, LeBlanc, Beauchesne & Boileau et al., 1996). Similar links amongst very preterm children have previously received little research attention.

Several mechanisms likely underlie the pathways via which social competence difficulties during early childhood may be detrimental to school functioning. For example, in terms of academic achievement, preschool-aged children struggling to regulate their emotions and behaviour may be less able to attend to and to effectively engage in higher order cognitive processes that are important for academic

achievement, such as working memory, planning and problem solving (Blair, 2002). These difficulties may contribute to poor performance on cognitive tasks (Phillips, Bull, Adams, & Fraser, 2002). Likewise, it may be expected that children who are unable to maintain a good mood, or who cannot effectively manage frustrations encountered during their day will be less likely to stay focused on learning tasks, may have difficulty undertaking and completing school tasks and may miss out on important information relevant to their learning and development. Alongside these difficulties, children characterised by behavioural difficulties, such as conduct problems and hyperactivity may have difficulty engaging in both social and academic learning opportunities, may have more difficulty following instructions, little interest in learning and a lack of cooperativeness (Arnold et al., 1999; Ladd & Burgess, 2001; Rimm-Kaufman, Early, Cox, Saluja, Pianta, Bradley et al., 2002). Further, it is possible that the behavioural, emotional regulation and social difficulties of very preterm and full term preschoolers persist into the middle childhood years.

Together, these emotional and behavioural difficulties raise concerns about the longer-term emotional, behavioural, social and academic development of very preterm children. Poor social competence likely contributes to difficulty developing relationships with classmates and school teachers, with evidence suggesting that teachers have a low tolerance for behaviourally challenging children. This may lead to social interactions characterised by more teacher negativity (Coie & Koepl, 1990) and underestimations of children's cognitive capabilities (Rimm-Kaufman et al., 2002), as well as lower levels of instruction and less positive feedback from the teacher (Arnold, 1997).

Additionally, children who have difficulty regulating their emotions may have a tendency to withdraw in response to anxious social and academic situations



potentially further interfering with peer relationships and learning engagement in the classroom (Blair, 2002). These difficulties combined with the increasing academic, behavioural and social demands of the school environment will likely be detrimental to children's overall motivation to learn, as well as their self-esteem, confidence and attitudes to school. Such negative connotations associated with early schooling may be difficult to alter. Together, these important findings advocate in favour of early intervention efforts aimed at reducing preschoolers' social competence problems with the distal objective of facilitating levels of school readiness, and consequently enhancing the on-going academic and personal development of very preterm and full term children.

Results of the current study also showed that children's intellectual functioning contributed to associations between social competence and later behavioural adjustment and academic achievement at school. In terms of school behavioural adjustment, IQ attenuated most links between social competence and outcome to some extent. However, all associations between social competence during early childhood and later behavioural adjustment at school remained statistically significant across both groups. These findings show that significant behavioural, emotional and social difficulties at school are not limited to those very preterm and full term children characterised by poor IQ during early childhood. While intellectual functioning during the preschool years has been recognised as an important predictor of school-aged children's behavioural adjustment amongst normative samples (Sonuga-Barke, Lamparelli, Stevenson, Thompson, & Hendy, 1994; Stanton, Feehan, McGee, & Silva, 1990), these associations have been rarely examined amongst preterm children. However, a study by Bayless et al. (2008) examined 69 very preterm (GA<32 weeks) and 70 full term children aged 6 to 12 years using the parent Strengths and Difficulties Questionnaire (SDQ) and the

Weschler Intelligence Scale for Children – Third edition (Wechsler, 1992) (Bayless et al., 2008). Results showed that low IQ scores were associated with poor emotional wellbeing amongst very preterm children but not full term children. While Bayless et al. (2008) examined older children it is interesting to note that IQ had differential effects on the behavioural functioning of very preterm and full term children at school. In contrast, the findings of the current study suggest that intellectual functioning made similar contributions to the behavioural adjustment at school of very preterm and full term children at age 6 years. Given that the children in our study were younger than those examined by Bayless et al. (2008), it may be that the adverse effects of poor IQ to behavioural functioning increase with age. However, further research will be necessary to better understanding the role of IQ in the development of social competence.

In terms of academic outcome, estimated child IQ fully attenuated links between poor social competence and difficulties in the subject areas of reading, spelling and language amongst children born very preterm. Similarly, in the full term group links between social competence problems and later difficulties with reading, maths and language comprehension were fully mediated by child IQ. However, preschoolers born very preterm characterised by poor social competence remained at an elevated risk for below average/delayed performance in math, whilst their full term counterparts remained at risk of poor performance in the subject of spelling. This suggests that there are at least subtle group differences in the ways in which preschoolers' social competence difficulties and intelligence influence later academic functioning at school.

Interestingly, it has been noted that school children born very preterm who are free from significant cognitive delay may experience particular difficulty in the subject of math (Breslau, Johnson, & Lucia, 2001; Klebanov et al., 1994; Klein et al.,

1989; Litt et al., 2005; Pritchard et al., 2008; Taylor, Hack, Klein, & Schatschneider, 1995). For example, a study by Pritchard, et al. (2008) examined a regional cohort of 102 very preterm ( $GA \leq 33$  weeks) and 108 full term comparison children at corrected age 6 years using the Woodcock-Johnson III Tests of Achievement (Woodcock, McGrew, & Mather, 2001) (Pritchard et al., 2008). Excluding children with severe cognitive delay (i.e.,  $IQ > 2SD$  below the control group mean), results showed that 46% of very preterm children were characterised by math impairment (defined as  $\geq 1SD$  below the control group mean) compared to 22% of full term children ( $p < .0001$ ). No significant group differences were found for rates of reading or language impairment.

Evidence of very preterm children experiencing particular difficulty in the area of math within one year of starting school is of particular concern as maths is a hierarchically arranged subject, in which each advancing step depends upon knowledge and the successful incorporation of preceding steps (Entwisle & Alexander, 1990). Therefore, it will be likely that very preterm children who are unable to master the basic foundations of math may have difficulty grasping subsequent mathematical concepts. Further, these findings are concerning as math ability at school entry has been identified as an especially robust predictor of later educational success (Duncan, Dowsett, Claessens, Magnuson, Huston & Klebanov, 2007), with the math performance of low birth weight school children found to deteriorate over time (Saigal et al., 2000).

Common mechanisms may underlie the links between poor social competence and particular difficulty in the subject of math for very preterm children. For example, previous preterm and mainstream research have demonstrated associations between math abilities in the classroom and a number of executive function skills generally referred to as cognitive functions used to plan and guide behaviour to

achieve a goal in an efficient manner (Kodituwakku, Kalberg, & May, 2001). Areas of executive functions associated with children's math performance include aspects of working memory and perceptual planning abilities (Bull & Scerif, 2001; Grunau, Whitfield, & Davis, 2002; Litt et al., 2005; Swanson & Sachse-Lee, 2001). Executive functions have also been directly implicated in children's developing social competence, with corresponding deficiencies found between executive function skills and aspects of social competence including distractibility, impulsivity and inattention (Hughes, 2002; Morgan & Lilienfeld, 2000; Pennington, 2002). For example, a study by Mitchell (2007) found that behavioural ratings of children's inhibitory control at age 6-7 years were significantly associated with concurrent levels of prosocial behaviour (Mitchell, 2007).

While examined to a lesser extent, similar associations have been found amongst children born very preterm. For example, a study by Wall (1996) examining 41 preterm and 43 full term children at age 5-7 years using a battery of executive function tasks (i.e., Visual Search; Korkman, Kirk, & Kemp, 1998, Tower of Hanoi; Simon, 1975, and verbal fluency) found several links between executive function and measures of child behaviour obtained using the Conner's Parent Questionnaire (Conners, 1970). Specifically, Tower of Hanoi efficiency scores and verbal fluency preservation were significantly correlated with children's levels of impulsivity and hyperactivity. Therefore, executive functioning capabilities may, at least in part, underlie the associations found in the current study between social competence difficulties and below average/delayed maths performance amongst children born very preterm. Further research will be required to better understand underlying connections between poor social competence and maths difficulty, the effects of IQ and the likely role of higher order executive processes.

### *7.5 A Broad Conceptual Framework and Developmental Perspective of Early Social Competence*

Importantly, results suggest that the examination of single and restricted domains of social competence are likely to lead to underestimations of the extent of social difficulties experienced by preschool-aged children born very preterm. However, by utilising a broad conceptual approach to social competence the current study was able to demonstrate social difficulties spanning emotional dysregulation, externalising and internalising behaviour problems, as well as some evidence of peer difficulties amongst preschoolers born very preterm. It also became apparent that despite these differences, very preterm and full term children were characterised by similar levels of social cognition, in terms of theory of mind, as well as largely similar interpersonal social behaviour at least at age 4 years. A broad conceptual approach also allowed the identification of particular areas of difficulty, with findings suggesting that very preterm children were more likely to experience clinically significant problems of emotional dysregulation rather than behavioural adjustment problems. The more detailed understanding of the social capabilities of very preterm children during early childhood may assist interventionists to concentrate their efforts on primary, rather than peripheral, areas of social difficulty for very preterm children. Recalling that the composite measure of social competence examined in the current study was based on children's levels of emotional dysregulation, externalising behaviour problems and interpersonal social difficulties, it is also likely that the effects of difficulties across domains accumulate with potentially adverse effects for children's successful transition to school.

The conceptual framework and developmental approach highlights differences in the infant clinical and socio-familial factors associated with compromised outcome across domains. For example, findings suggest that the externalising and internalising behaviour problems of very preterm children during the early childhood

period may reflect differing underlying aetiology. Similarly, a study by Reijneveld, et al. (2006) examining 402 very preterm (BW<1,500 g or GA<32 weeks) children and a population sample of 6,007 full term comparison children at age 5 years using the parent Child Behavior Checklist found clinical predictors varied according to specific behavioural outcomes (Reijneveld et al., 2006). Specifically, attention problems were associated with more artificial ventilation and steroid use, while internalising behaviour problems were predicted by the presence of moderate to severe intraventricular hemorrhage (grade 3-4). While the clinical risk factors identified were different from those of the current study, Reijneveld's findings further highlight the importance of identifying risk factors associated with particular domains of social difficulty. While current study findings require replication, the identification of specific risk factors associated with increased emotional dysregulation, and externalising and internalising behaviour problems will likely facilitate the early identification of those very preterm children at elevated risk of difficulties in one or more domains of social competence.

Further, the adoption of a developmental perspective highlighted the differential roles of specific infant clinical and socio-familial characteristics in relation to later social competence. For example, while infant clinical factors explained similar levels of within group variance concerning emotional dysregulation (14%) and externalising behaviour problems (15%) a lesser amount of variance (5%) was explained concerning the internalising behaviour difficulties of very preterm children at age 4 years. Furthermore, a greater proportion of within group variability in emotional dysregulation and externalising behaviour problems could be explained by the additional consideration of socio-familial characteristics (i.e., emotional dysregulation 34%; externalising behaviour problems 22%). In contrast, further levels of variance concerning internalising behaviour problems amongst very preterm

children could not be explained by those socio-familial characteristics examined in the current study. While requiring further validation, these findings suggest similarities in the underlying aetiology of emotional dysregulation and externalising behaviour problems amongst very preterm preschoolers while the clinical and socio-familial contributors to later internalising behaviour problems may be quite different. Therefore, the use of a broad conceptual framework embedded within a developmental theoretical perspective allowed greater insight into the early social profile of very preterm children which may be valuable for the development and provision of targeted intervention programmes to those very preterm children at elevated risk of social difficulties. Efforts to minimise the social competence problems experienced by some preschoolers born very preterm may also facilitate their successful transition to formal schooling.

#### *7.6 Limitations of the Current Study*

Some caveats should be considered when evaluating the results of this study. First, a number of measurement issues are evident. Specifically, while very preterm children were found to be at increased risk of emotional dysregulation it is important to acknowledge that this finding was based solely on parent report. Consequently, this result must be interpreted cautiously as parents experiencing elevated levels of psychological distress may be subject to negative-reporting bias (Fergusson, Lynskey, & Horwood, 1993). As previously mentioned in the Introduction, concerns about negative reporting bias may be particularly relevant in the current study as women experiencing preterm birth are well known to be at increased risk of high anxiety. Therefore, links between very preterm birth and emotional dysregulation during the early childhood period may have been strengthened by the addition of

corresponding information about the emotional regulation abilities of study children from preschool teachers.

It is also noted that two items of the Penn Peer Interactive Play Scale (PPIPS) were omitted from the parent questionnaire in error. Specifically, one item from the play disconnection subscale and one item from the play disruption subscale were missing. While the inclusion of these items may not have significantly altered the current study findings it is acknowledged that the omission of these items is a limitation.

There are also a number of shortcomings concerning the examination of maternal anxiety. It is noted that the Hospital Anxiety and Depression Scale used in the current study is a self-report measure. Therefore, in light of the aforementioned risks of negative reporting bias it is acknowledged that the additional use of a more objective marker of stress, such as cortisol levels, may have provided valuable information concerning the physiologically based levels of anxiety experienced by mothers of very preterm children across time. Such information could have been useful in attempting to better understand the complexities of associations between high maternal anxiety and adverse child outcomes. For example, the potentially differential effects of perceived and physiological levels of anxiety could have been examined in relation to children's social development. We also have no information concerning the levels of maternal anxiety evident prior to the arrival of the very preterm infant. It is possible that some of the study mothers were already experiencing elevated levels of anxiety before childbirth, as associations between psychological distress and preterm delivery have been established (Hedegaard, Brink Henriksen, Sabroa & Jorgen Secher, 1993; Peacock, Bland & Ross Anderson, 1995). Further, it is acknowledged that the associations found between emotional dysregulation, externalising behaviour problems and high maternal anxiety may be



the result of, at least in part, genetic rather than environmental influences. In other words, some very preterm children may have been more genetically vulnerable than others to poor emotional regulation and/or behavioural adjustment difficulties. Therefore, the addition of physiological information and knowledge concerning possible genetic influences may have allowed for a better understanding of the underlying mechanisms contributing to the elevated rates of emotional dysregulation and externalising behaviour difficulties found within the very preterm sample.

Further, a lack of reliable, standardised measures of social competence suitable for use with preschool-aged children may have unfavourably influenced the findings of the current study. For example, while very preterm children were found to be at greater risk of emotional dysregulation and externalising and internalising behaviour difficulties, it was somewhat surprising that group differences were not significant concerning overall levels of interpersonal social functioning across the home and preschool environments. Subsequently, there are concerns that the assessment tools used in the current study may have lacked the sensitivity to detect subtle differences between the early functional social capabilities of very preterm and full term children. There are also concerns regarding the limited reports of reliability and predictive validity concerning measures of emotional regulation suitable for use during early childhood. While beyond the scope of the current study, this is an important measurement limitation that requires attention. Further, it is acknowledged that the associations found between internalising behaviour problems and low birth weight were based on parent and preschool teacher responses to the emotional symptoms subscale of the SDQ, which consists of only five items. The inclusion of additional measures of internalising behaviour problems may have strengthened the reliability of this finding.

In addition, the findings of the current study were based predominantly on the basis of information obtained via the use of questionnaire reports. A more in-depth understanding of the early social capabilities of very preterm children may have been gained via the inclusion of additional research methods. For example, observational research examining the peer relations, behaviour and emotional regulation of very preterm and full term children across both the home and preschool environments may have strengthened current study findings, as well as shed more light on the nature of the emerging peer relationships of children born very preterm.

It is also important to acknowledge that group differences in social cognition may have been concealed by shortcomings in the administration of the ToM tasks. Specifically, the order in which the three tasks were presented to all study children was not counterbalanced. Therefore, it may be that the highest percentages of pass rates for both very preterm and full term children on the first theory of mind task presented (Sally-Ann) were contributed to by elevated levels of attention and interest on the initial presentation of such stimulus. Additionally, group differences may have been obscured as no forced choice criteria were applied. This procedure may be helpful in assisting children to focus more clearly on the relevant response options (Perner, Lang, & Kloo, 2002). Specifically, while children were encouraged and given ample opportunity to respond to all of the ToM questions asked in the current study, children were not required to make a forced choice between two possible answers (i.e., “Will Sally think the ball is in the basket or will she think it is in the box?”). Rather, children who did not respond to a question were recorded as having missing data. Consequently, data from three children (2 very preterm, 1 full term) were excluded from use in this part of the analysis due to a single ‘missing’ response. Importantly, all children with missing data either failed or did not respond to additional questions pertaining to that particular ToM task. While only a small

number of children were excluded from this part of the analysis, the use of a forced choice strategy may have strengthened current findings.

Further, while the regression models presented demonstrated an adequate fit for our data it was somewhat surprising that only a few infant clinical and socio-familial factors examined were significantly associated with social competence outcomes. This is particularly evident in terms of internalising behaviour problems amongst the very preterm group that were predicted only by low birth weight. Therefore, it may be that other aspects of very preterm children's clinical history and environment account for additional variance in social competence outcomes. These factors may better explain the associations between very preterm birth and emotional dysregulation and poor behavioural adjustment during early childhood.

More detailed information concerning the clinical presentation of the full term comparison children around the time of birth may also have been beneficial. Specifically, a number of the infant clinical factors examined are not unique to preterm populations. For example, term born infants may also be clinically characterised by patent ductus arteriosus, require the receipt of indomethacin and/or present with sepsis (Ferriero, 2005; Sameshima, Kodama, & Kaneko et al. 2008). Further, estimates suggest that 0.2 to 0.5% of live births present with some form of neurological injury (Ferriero, 2005). Such clinical information would have allowed a more detailed comparison of sample characteristics at term across the study groups.

A number of statistical concerns also warrant discussion. Specifically, as some measures of social competence were found to be significantly right (positive) skewed it could be argued that all study analyses should have been undertaken using non-parametric tests, or that log transformations should have been performed. However, in order to satisfy associated statistical assumptions the sole use of parametric testing would have required the dichotomising of all study variables. This was avoided for

several reasons, including a lack of clear cut-points in the data and the likely loss of valuable mathematical information associated with the conversion of continuous variables to categorical variables (Aiken & West, 1991).

In addition, the likelihood of associated Type 1 errors was increased due to the exploratory nature of the regression analyses involving multiple testing. Thus, there was a greater risk of observing a statistical difference between the very preterm and full term groups when in fact there was none. Additionally, the identification of infant clinical factors associated with emotional dysregulation and behavioural adjustment difficulties may have been compromised by a lack of statistical power. Specifically, in some instances low numbers of very preterm infants were characterised by a particular clinical feature around the time of birth. For example, few very preterm children in our sample were characterised by necrotising enterocolitis ( $n=7$ ), intraventricular hemorrhage ( $n=5$ ) or periventricular leukomalacia ( $n=3$ ). In contrast, the ability of clinical factors to further account for within group variability may have been reduced when the presence of these factors was widespread. For example, 83% of very preterm children received maternal antenatal steroids around the time of birth. It is therefore important to note that those infant clinical and socio-familial predictors of social competence problems identified amongst children born very preterm will require further replication.

Finally, it is noted that the very preterm sample examined consisted of a high number of twins (very preterm  $n=36$ ; full term  $n=4$ ). This may have led to within family clustering in the data (Carlin, Gurrin, Sterne, Morley, & Dwyer, 2005), as the ratio of parents-to-children in the very preterm group would have been lower than that of the full term group. This may have contributed to stronger correlations in the very preterm sample.

### *7.7 Areas for Future Research*

Research addressing the aforementioned methodological limitations will be required to further examine the on-going development of social competence amongst children born very preterm. This research will be important for better understanding of the changing nature, prevalence and underlying aetiology of the early social competence difficulties associated with very preterm birth. It may also be fruitful for such efforts to examine a more in-depth range of competencies within each of the four developmental domains considered in the current study. This may include, for example, the study of additional aspects of emotional regulation such as the development, use and perceived effectiveness of children's emotion regulation coping strategies, and the examination of physiological and/or experiential aspects of emotional regulation. Such research will likely contribute to a better understanding of the breadth of the emotional regulation difficulties experienced by children born very preterm, and may allow improved understanding of the associated implications for behavioural and social development.

Additionally, the identification of protective factors associated with optimal social competence amongst children born very preterm will be important. Efforts are also needed to examine the extent to which very preterm children are at risk of comorbid patterns of impairment across multiple developmental domains relevant to successful social functioning, as well as improvements in knowledge about the changing nature of social difficulties and inter-relations across relevant developmental domains over time. It will also be important to examine the on-going relationships between clinical presentation at birth, environmental and family functioning and the social competence of very preterm children beyond the preschool period. Longitudinal research of this nature may further enhance the identification of very preterm children who are at increased risk of pervasive social difficulties

throughout development. Finally, within the context of rapidly changing imaging technology it will be important to continue the pursuit towards the identification of neurological markers associated with social compromise amongst very preterm children.

### *7.8 Clinical Implications*

The findings of the current study raise a number of implications for clinical practice. Clearly, increased risks of impairment amongst children born very preterm are not limited to physical, sensory and cognitive aspects of development. Rather, this study has clearly shown that some preschoolers born very preterm may also be at elevated risk for emotional dysregulation and behavioural adjustment difficulties. Moreover, results confirm that very preterm children at risk of social competence difficulties may be identified prior to starting school. This contribution to the existing literature is particularly important as it highlights opportunities for early interventionists to facilitate better school readiness amongst this unique population. The evidence produced by the current study also lends support to calls for the broadening of intervention curricula, which has predominantly focused on the achievement of cognitive goals amongst very preterm children (Hoy, Sykes, Bill, & Halliday, 1991).

The current study also highlights the potential utility for interventionists to consider the adverse effects of maternal anxiety on the social development of children born very preterm. Efforts to reduce levels of anxiety amongst mothers of very preterm children will likely be important in optimising children's social competence. Previous intervention efforts aimed at the reduction of maternal anxiety include the facilitation of adequate social and spousal support (Crnic & Greenberg, 1987; Crnic et al., 1983; Feldman, 2007; Miceli et al., 2000; Singer, Davillier,

Bruening, Hawkins, & Yamashita, 1996), training in the use of relaxation techniques and cognitive coping strategies (Cobielle, Mabe, & Forehand, 1990), as well as the promotion of responsive parenting and greater attachment security (Gunnar & Quevedo, 2007). Some successes have been reported. For example, a study by Feijó, et al (2006) that examined 40 preterm (GA<37 weeks) babies and their mothers using the State Anxiety Inventory (Spielberger et al., 1970) and an Infant Massage Questionnaire designed for this study found that mothers who massaged their preterm infants experienced reduced anxiety levels compared to mothers who observed infant massage (Feijó, Hernandez-Reif, Field, Burns, Valley-Gray & Simco, 2006). The identification of mothers of very preterm babies and preschoolers who are experiencing high levels of psychological distress may be important for intervention efforts aimed at optimising the social competence and school readiness of children born very preterm.

### *7.9 Conclusion*

Clearly the adverse developmental outcomes associated with very premature birth are not limited to the areas of physical, sensory, neurological and cognitive development. As hypothesised, social competence difficulties are also detectable amongst some very preterm children before school entry, particularly in the form of emotional dysregulation and externalising and internalising behaviour problems. While hypothesised differences concerning interpersonal social behaviour and theory of mind were not evident, the emotional dysregulation and behavioural adjustment difficulties evident were significantly predicted by infant clinical and socio-familial factors. These included male gender, indomethacin, low SES and elevated mean levels of maternal anxiety. Further, the extent of a child's overall social competence difficulties were found to similarly place some very preterm and full term children at

elevated risk of academic compromise and behavioural problems at school. Importantly, while child IQ largely attenuates links between poor social competence and academic difficulties, risks of behavioural problems at school are not limited to those children characterised by poor intellectual functioning. Further, these findings raise serious concerns for the long term educational and social outcomes of very preterm children, and highlight the importance of increasing levels of awareness, amongst educators and other professional groups, concerning the wider developmental issues that may be associated with very preterm birth. Greater awareness of the social difficulties that very preterm children may experience prior to and around the time of transition to school may facilitate the provision of appropriate supports to maximise the school readiness of very preterm children and their subsequent functioning. Finally, while prematurity is not always associated with compromised social development, the early identification of those children born very preterm who may be at increased risk of emotional, behavioural and interpersonal difficulties is important.



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**Author note:** Correspondence concerning this dissertation should be addressed to Kelly Hood, c/o Associate Professor Lianne Woodward, Department of Psychology, University of Canterbury, Private Bag 4800, Christchurch, South Island, New Zealand. Electronic mail may be sent to [kelly\\_hood@hotmail.com](mailto:kelly_hood@hotmail.com).

## Publications and Communications during Canditure

### *Conference Presentations*

2004 ASID Conference, Christchurch, New Zealand. Early Social Development of Preterm Infants. Hood, K., Champion, P. and Woodward, L.

2007 Australasian Human Development Association (AHDA) Conference, Sydney, Australia. Social Competence of Preschool Children Born Very Preterm. Hood, K., Champion, P., Knight, J., Clark, C. and Woodward, L.

2008 New Zealand Psychological Society Annual Conference (NZPS), Christchurch, New Zealand. Social Competence of Preschool Children Born Very Preterm and Implications for School Functioning. Hood, Kelly M., Champion, Patricia and Woodward, Lianne.

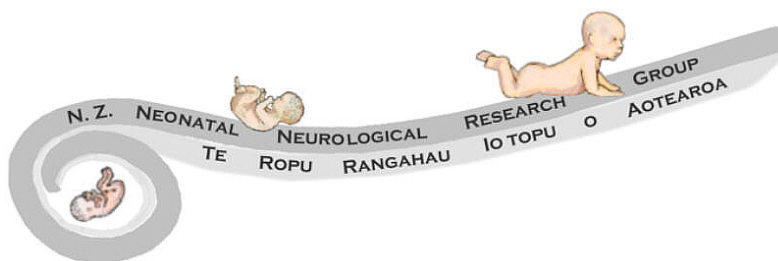
2008 Showcase Canterbury. Emotional Regulation of Preschool Children Born Very Preterm and Implications for School Functioning. Hood, Kelly M., Champion, Patricia and Woodward, Lianne.

### *Poster Presentations*

2006 International Society for the Study of Behavioural Development (ISSBD), 19<sup>th</sup> Biennial Meeting, Melbourne, Australia. Early Social Development of Children Born Very Preterm. Hood, K., Champion, P., Ware, J. & Woodward, L.

2008 International Society for the Study of Behavioural Development (ISSBD), 20<sup>th</sup> Biennial Meeting, Wurzburg, Germany. Clinical and socio-environmental predictors of social competence amongst preschool children born very preterm. Hood, Kelly, Champion, Patricia and Woodward, Lianne.

## APPENDIX A: Parent/Caregiver Information Sheet



Woman's Health Division, Department of Paediatrics, Christchurch, NZ  
 Canterbury Child Development Group, University of Canterbury, NZ  
 Psychological Medicine, Christchurch School of Medicine, NZ

### STUDY OF PREMATURE CHILDREN INFORMATION SHEET

**Principal Investigator:** Dr Lianne Woodward, Department of Education, University of Canterbury, Private Bag 4800, Christchurch, Ph. (03) 364 2255.

You and your child are invited to take part in the 4-year follow-up study of children born very low birth weight. This study is being carried out by Dr Lianne Woodward, a Developmental Psychologist (University of Canterbury), Dr Nicola Austin, a Paediatrician (Christchurch Women's Hospital), Dr Patricia Champion, a Developmental Psychologist (Champion Centre) and Dr Terrie Inder, a Paediatrician now based in Australia.

#### WHAT IS THE STUDY?

The purpose of the study is to learn more about the health and development of children who were born too early at Christchurch Women's Hospital. Approximate 100 children who were born premature between 1998 and 2000 are taking part in the study. In addition, 100 children who were born close to full term around the same time are also being invited to participate in the study. The purpose of the study is to compare the health and development of children who were born premature with children of the same age who were not born prematurely. The results of this study will help us learn more about which premature children may or may not have problems and what causes these problems.

#### WHAT DOES THE STUDY INVOLVE?

If you agree to take part, your child will undergo a comprehensive developmental assessment close to their 4th birthday. This assessment will include:

1. An assessment of your child's cognitive development using a standard child development test and a series of problem solving games.
2. An assessment of your child's developing language.
3. Observations of your child playing with a familiar person.
4. A comprehensive paediatric examination, including a brief hearing test.
5. Completion of a short interview and questionnaire about your child's health, development and family circumstances.

This assessment will take place during two 1 ½ - 2 hour sessions at the Canterbury Child Development clinic. We would be happy to visit you in your home for one of these appointments if you would prefer not to attend two clinical appointments.

## **PARTICIPATION**

Your participation in this study is **entirely voluntary** (your choice). You do not have to take part in this study, and if you choose not to take part we will respect your choice.

If you agree to take part in the study **you are free to withdraw at any time** without having to give a reason. If you decide not to participate or to withdraw, this will not affect the health care of you or your child. If you have any queries or concerns about your rights as a participant in this study you may wish to contact a Health and Disability Service Consumer Advocate on telephone (03) 377 7501 or 0800 377 766 outside Christchurch.

## **CONVENIENCES OR HAZARDS WHICH MIGHT BE EXPECTED**

There are no known risks of these evaluations. All information that is collected will be done with great care for your child so as not to cause them any upset. If you are travelling from outside Christchurch, your travel costs will be reimbursed. We are happy to provide you with feedback on your child's assessment.

## **COMPENSATION**

In the unlikely event of a physical injury as a result of your participation in this study, you will be covered by the accident compensation legislation with its limitations. If you have any questions about ACC please feel free to ask the researcher for more information before you agree to take part in this study.

## **CONFIDENTIALITY**

All information you give us will be treated in the strictest confidence. Your identity will not be revealed in any reports based on the study. No information will ever be released about you or your child to a third party without your written consent. The study will have a comprehensive security system, with all information you provide being stored anonymously on computer files. Access to these files will be confined to study investigators.

## **IF YOU WANT TO KNOW MORE**

If you want to know more about the study (either now or at a later date) please feel free to contact either:

*Ms Carole Spencer*, Senior Research Nurse, Christchurch Women's Hospital. Ph: 364 4741, or *Ms Michelle Davey*, Research Co-ordinator, University of Canterbury. Ph: 366 7001 Ext. 4817, *Dr Lianne Woodward*, Developmental Psychologist, University of Canterbury. Ph: 364 2255 or *Dr Nicola Austin*, Paediatrician, Christchurch Women's Hospital, Ph: 364 4699

We are committed to treating all our study participants in a fair and ethical manner. This study has received ethical approval from the Canterbury Ethics Committee. Finally, we would like to thank you for considering assisting us with this research.

Lianne Woodward                      Carole Spencer    Michelle Davey    Nicola Austin

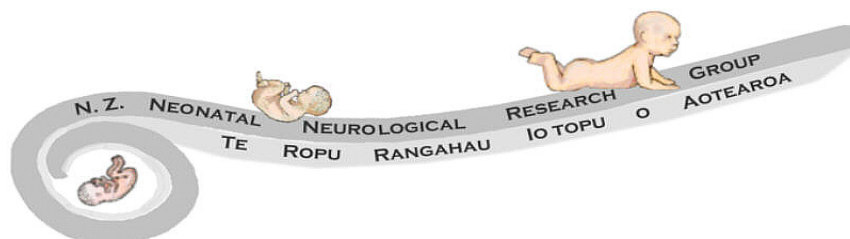
Principal Investigator      Researcher                      Researcher      Principle Investigator

**APPROVED BY THE CANTERBURY ETHICS COMMITTEE**

Month, 2002

Reference: CTY/ 02/10/174

## APPENDIX B: Parent/Caregiver Consent Form



Woman's Health Division, Department of Paediatrics, Christchurch, NZ  
 Canterbury Child Development Research Group, University of Canterbury, NZ  
 Psychological Medicine, Christchurch School of Medicine, NZ

### STUDY OF PREMATURE CHILDREN (Reference: CTY/04/11/212)

#### 4- YEAR CONSENT FORM

- I have read and understood the information sheet dated \_\_\_\_\_ for my child to participate in this follow up study comparing the development of children who were born premature and children who were born full term. I have been given an opportunity to discuss the study and ask questions and am satisfied with the answers.
- I have had enough time to consider whether we will take part in the study, and to discuss my decision with the researcher or a person of my choice.
- I know who to contact if I have any questions about the study.
- I understand that our participation in this research is **confidential** and that no material which could identify me will be used in any study reports, or made available to anyone else without my approval in writing. I understand that this information will be stored in a locked, limited access location for a set time period.
- I also understand that my child and I can withdraw from the study at any time.
- I understand the compensation provisions for the study.
- I agree to members of the research team having access to medical information from my child's general practitioner and hospital records for cross checking the number and dates of any major or minor illnesses that I have recorded on the study forms. **YES/NO**
- I am willing for the research team to contact my child's class teacher to obtain information on my child's health and progress during the last year. **YES/NO**
- I wish to receive a summary of the results of this study. **YES/NO**

I consent to my child and I taking part in this study.

Child's Name: \_\_\_\_\_ Parent/s  
 Name: \_\_\_\_\_

Signature of Parent/s: \_\_\_\_\_ Date: \_\_\_\_\_

In my opinion, consent was given freely and the participant understands what is involved in this study.

Researcher's Name: \_\_\_\_\_

**Signature of Researcher:**

\_\_\_\_\_ **Date:** \_\_\_\_\_



## APPENDIX C: Social Cognition Measures

### *The 'Sally-Ann' Task*

Control-Reality Question Which doll is Sally?

Control-Reality Question Which doll is Ann?

Control-Reality Question Did Sally see Ann take the ball out of the basket and put it in the box?

False Belief Question Where will Sally first look for her ball?

Control-Reality Question Where is the ball really?

Memory Question Where was the ball in the beginning?

### *The 'Smarties' Task*

Control-Reality Question What do you think is in this packet?

False Belief Question What will Mickey think is inside this packet?

Control-Reality Question Does it look like this packet has smarties in it or does it look like it has crayons in it?

Control-Reality Question What is really in this packet? Are there really smarties in this packet or are there really crayons in this packet?

### *The Fishing Story (graphics over page)*

Control-Reality Question What is the man doing?

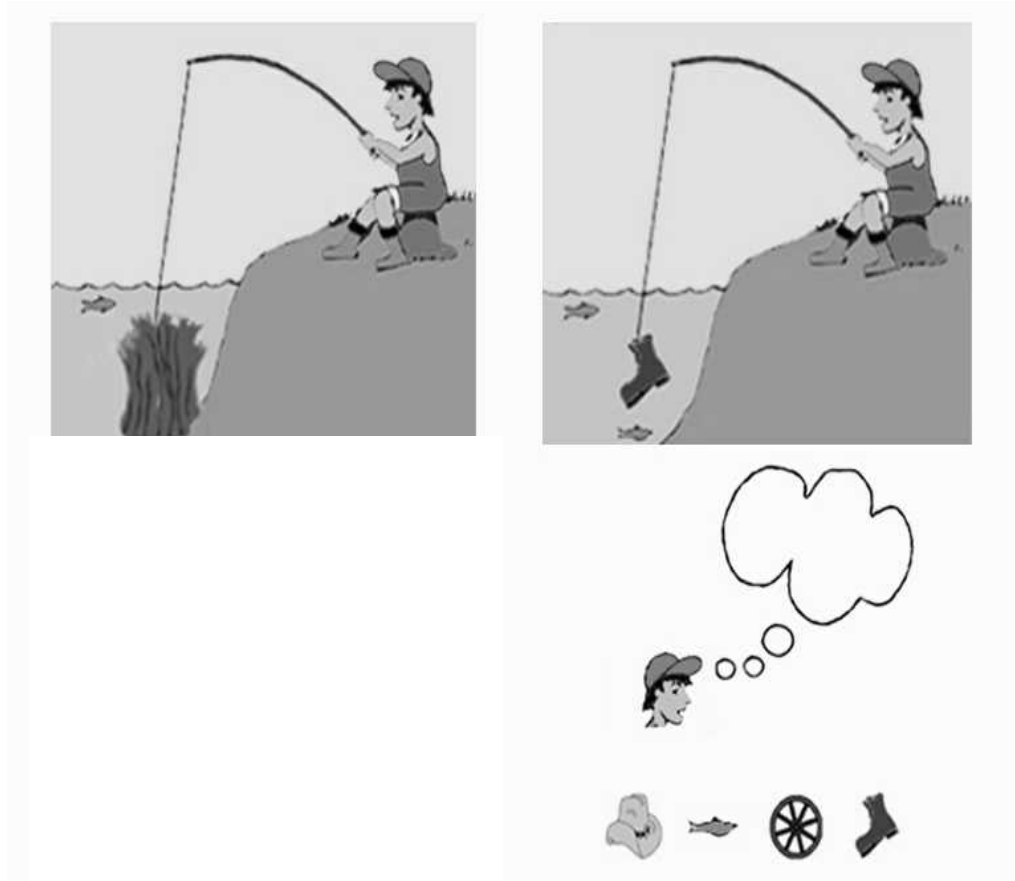
Control-Reality Question Can you see the end of the fishing line?

Control-Reality Question Do you think the man can see in the water?

Control-Reality Question Do you think the man can see under the plant?

Control-Reality Question What can you see on the end of the man's fishing line?

False Belief Question      What does the man think is on the end of his fishing line?"



Siegal & Varley (2002).

## APPENDIX D: Coding Guidelines for Parenting Behaviour

### *PARENT BEHAVIOUR - NEGATIVE AFFECT TOWARD THE CHILD*

(Adapted from Chase-Lansdale et al., 1988)

This scale measures the intensity and frequency of the parent's degree of disapproval, anger, and negativism expressed toward the child while working on each task.

Criteria:

#### Displays of negative affect:

Expressions of disapproval, tense body, negative voice when correcting, abruptness, tense facial muscle-strained expression, raised eyebrows, screaming, sharpness, curtness, anger, annoyance, irritability

Frequency is fundamental to all ratings. The more frequent the expressions are the higher the rating will be. However, the amount of negative affect expressed should then be thought about in relation to the intensity of each expression.

Ratings:

1. None. No expression of negative affect.
2. Slight expression of negative affect. One or two brief and low intensity expressions of negative affect may occur.
3. Somewhat. Three to five expressions of negative affect. There are low intensity displays of negative affect. For example, the parent may seem tense during the session and a few expressions of non-acceptance or slight anger or irritation toward the child might occur. However, also code a three if one period of intense negative affect occurs during the session.
4. Frequent. Expresses some irritation, frustration, annoyance or disappointment in tone, such as curtness or actual words or with facial expressions, such as frowns, scowls. Negative gestures are interspersed throughout session, parent may be sharp and punitive, or two periods of very intense negative affect may occur.
5. High intensity and frequent negative affect. Exhibits intense displeasure or disapproval, such as irritation, annoyance, frustration, disappointment or sarcasm. May show passive-aggressive behaviour, such as rejecting or taunting or teasing the child when in distress or seems quite angry with child.

*PARENT BEHAVIOUR - INTRUSIVE/OVERCONTROLLING*  
(Adapted from Chase-Lansdale et al., 1988)

This scale assesses the extent to which parental behaviour is ill-timed, intrusive, and excessively and inappropriately controlling relative to what the child is doing. The parent's behaviour may be ill-timed in the sense that it disrupts child's own goals and pursuits, or lacks empathy or synchrony with the child's feelings and action, respectively, and thus is psychologically intrusive. Intrusive behaviour is likely to be dictated by a parental agenda regarding what should be going on and disregarding child's behaviour.

Examples:

During the first few minutes of play P explains the rules to C in a clear manner, but with the focus on what C can not play with. The instructions may be given in a dictatorial fashion (e.g. "Don't let me catch you playing with this").

During play P directs/structures play in a way that does not allow C to explore and decide what to play with. P often tells C what to play with or in some way decides what parent/child will play with together, without regard to C's wishes (e.g. "We're going to play with this toy now" or "Here, you play with these blocks now"). P interrupts or distracts C's own play or conversation.

The provision of constant verbal directions that are timed according to what C is doing and leaves C with little room for autonomous functioning (e.g., "quizzing" child in an interfering way - "What colour is that? How about that? Who is that?).

Intrusive manipulations of C's body or materials to force C to behave in a certain manner, (e.g. pushing C's arm back and forth to "help" him do something).

Interventions into C's actions before C has a real chance for mastery – not timed to C's degree of coping, but rather to P's need to "get on with it".

Prolonging separation with extensive explanations that do not seem to be necessary, given C's affective state.

While child is pretending/participating in pretend with parent, parent usurps control by trying to force in literal explanations rather than going along with child's non-literalness.

Ratings:

1. No evidence of intrusiveness (or too slight to count) is observed
2. One verbal intrusion (e.g. child finishes a task and starts to get the next task out of the container. Parent interrupts child's actions by asking child to name the shapes in the previous task). Interventions into child's actions which are less intrusive and controlling than a level 3 physical intrusion because of the intent of the parent's action (e.g. parent takes over finishing a task in response to a child's request rather than an unprompted intrusion). Unnecessarily dictatorial clean-up

instructions; subtle intrusions that don't necessarily distract child. The tone of several of the parent's interactions may be quite directive/controlling.

3. One instance of physical intrusion, which clearly stops or changes the child's behaviour (e.g. parent physically intervenes by removing a piece from a puzzle which the child has incorrectly placed, or parent does part of the task for the child without the child requesting help). Or two instances of verbal intrusions.

4. May combine several types of intrusiveness (e.g. one instance of physical intrusion, plus instances where parent is brisk and directs child through task rather than allowing the child time to work at his/her own pace a figure out what to do). Two instances of physical intrusion. A directive style of interaction, which characterises the whole task and leaves the child little room for autonomous functioning.

5. Instances of intrusiveness are frequent or especially salient and characterize much of the parent's way of relating to the child.

## APPENDIX E: Correlations Matrices and Bivariate Associations

*Table E.1 Correlations between Infant Clinical Characteristics and Social Competence Problems in Very Preterm Children*

Characteristics	1	2	3	4	5	6	7
1. Emotional dysregulation	1						
2. Internalising behaviour	.42	1					
3. Externalising behaviour	.69	.27	1				
4. Gestational age	-.12	-.08	-.09	1			
5. Birth weight	-.10	-.21	-.06	.72	1		
6. Total days of ventilation	.13	.12	.06	-.61	-.52	1	
7. Total WMI score	.20	.01	.16	-.34	-.10	.23	1

Note:  $p < .01$ ,  $p < .05$ . Spearman's rho correlations presented for continuous variables

*Table E.2 Correlations between Socio-Familial Characteristics and Social Competence Problems in Very Preterm Children*

Characteristics	1	2	3	4	5	6	7	8
1. Emotional dysregulation	1							
2. Internalising behaviour	.42	1						
3. Externalising behaviour	.69	.27	1					
4. Maternal age (at term)	-.21	.01	-.18	1				
5. Maternal education (2 years)	.11	.16	.14	-.30	1			
6. Socio-economic status (2 years)	.26	.08	.12	-.11	.34	1		
7. Maternal depression (1-4 years)	.15	-.05	.005	-.10	-.07	.12	1	
8. Maternal anxiety (1-4 years)	.37	.13	.34	-.20	.09	.18	.55	1

Note:  $p < .01$ ,  $p < .05$ . Spearman's rho correlations presented for continuous variables

*Table E.3 Correlations between Child Characteristics and Social Competence Problems in Very Preterm Children*

Characteristics (4 years)	1	2	3	4	5	6
1. Emotional dysregulation	1					
2. Internalising behaviour	.42**	1				
3. Externalising behaviour	.69**	.27**	1			
4. Estimated IQ	-.34**	-.12	-.29**	1		
5. Language	-.26*	-.12	-.26**	.75**	1	
6. Motor development	-.29**	-.17	-.01	.47**	.32**	1

Note:  $p < .01$ ,  $p < .05$ . Spearman's rho correlations presented for continuous variables



*Table E.4 Correlations between Social Competence Problems at 4 Years and Behavioural and Academic Functioning at Age 6 Years*

Measures	1	2	3	4	5	6	7	8	9	10
1. Social Competence problems (4 years)		.53**	.52**	.51**	.51**	.41**	.29**	.42*	.33**	.16
2. Conduct problems	.21*		.64**	.74**	.73**	.39**	.19	.06	.27**	.21*
3. Hyperactivity/Inattention	.39**	.36**		.82**	.79**	.27**	.28**	.21*	.35**	.28**
4. Inhibitory control problems	.43**	.56**	.75**		.83**	.40**	.26**	.10	.27**	.25**
5. Emotional control problems	.37**	.53**	.59**	.75**		.38**	.20*	.11	.25*	.18
6. Peer problems	.40**	.28**	.39**	.46**	.35**		-.02	.11	.01	.04
7. Below average/delayed reading	.28*	.08	.35**	.35**	.36**	.11		.57**	.82**	.67**
8. Below average/delayed maths	.22**	.04	.40**	.38**	.40**	.23*	.71**		.61**	.53**
9. Below average/delayed spelling	.29**	.08	.42**	.41**	.37**	.13	.90**	.74**		.60**
10. Below average/delayed language comprehension	.15	.04	.35**	.43**	.37**	.25*	.66**	.68**	.71**	

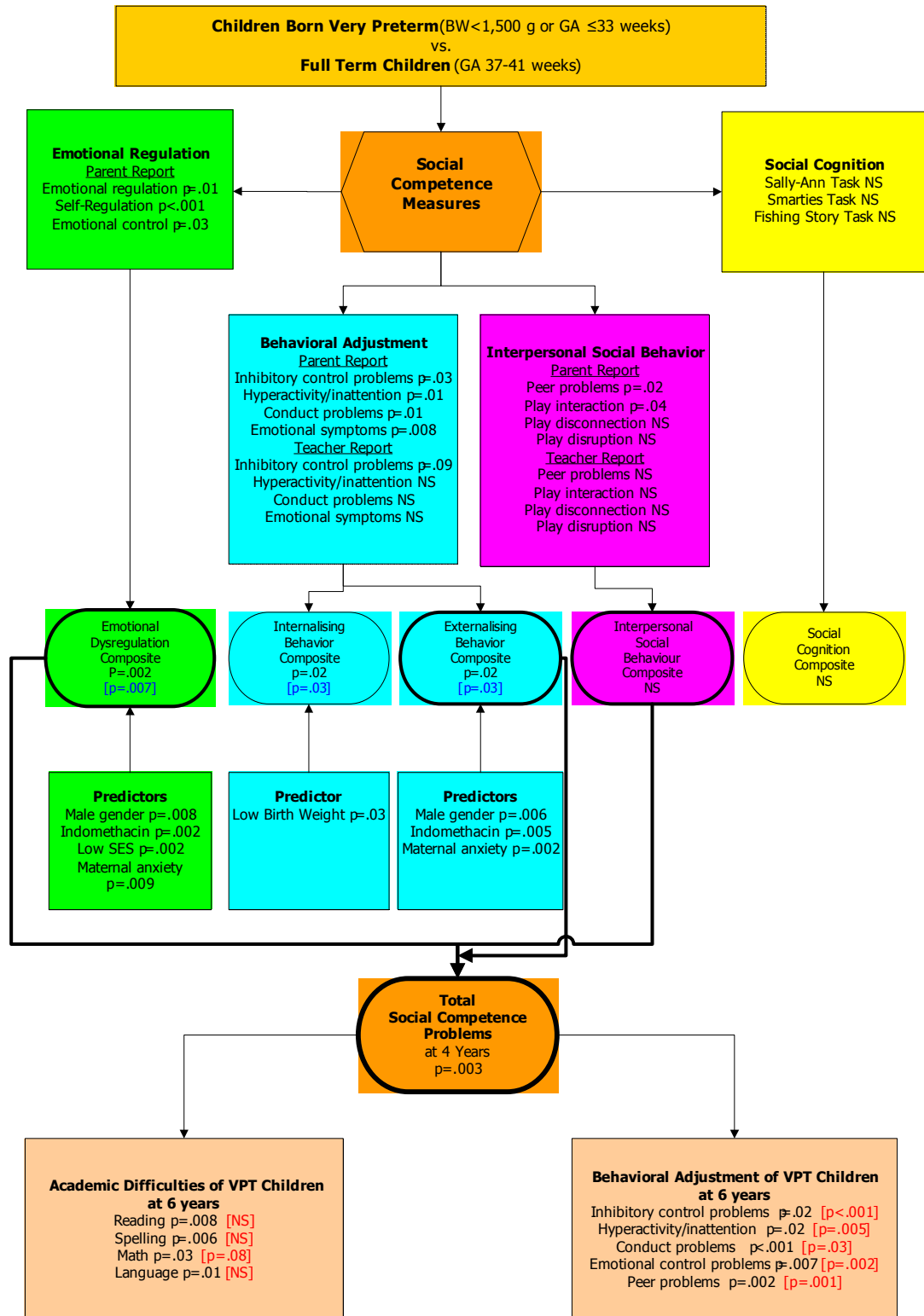
*Note:* Correlations above the blank diagonal line are for children born **full term** (N=101); those below the diagonal are for children born **very preterm** (N=85).  
 p<.01, p<.05

*Table E.5 Associations between Socio-Familial Factors and Internalising Behaviour Problems in Children Born Very Preterm at Age 4 Years*

Socio-Familial Factor	N	Mean (SD) Internalising behaviour	F	p
Socio-economic status (2 yrs)				
Unskilled/Unemployed	24	102.66 (9.95)	0.04	.95
Skilled/Semi-skilled	45	103.05 (9.35)		
Professional	34	102.42 (9.73)		
Maternal age (2 yrs)				
<25 years ( <i>n</i> =17)	17	100.62 (9.34)	1.44	.24
25-35 years ( <i>n</i> =67)	67	102.43 (9.80)		
>35 years ( <i>n</i> =19)	19	105.79 (8.33)		
Maternal education (2 yrs)				
Left school at 13-16 years	39	104.60 (10.05)	1.99	.14
Further secondary/trade	42	101.76 (8.68)		
Higher education	22	99.64 (8.27)		
Mean maternal anxiety (1-4 yrs)				
Low (score<4)	41	102.84 (10.09)	1.14	.32
Medium (score 4-6)	27	100.61 (9.86)		
High (score>6)	35	104.29 (8.47)		
Mean maternal depression (1-4 yrs)				
Low (score 0-3)	48	102.84 (11.13)	0.34	.70
Medium (score 4-6)	29	103.69 (8.16)		
High (score>6)	26	101.54 (11.51)		
Parental changes (0-4 years)				
0 parental changes	76	102.07 (8.53)	0.90	.40
1 parental change	7	104.24 (16.20)		
≥2 parental changes	13	105.68 (10.33)		
Negative parenting behaviour (4 yrs)				
≤4 displays	59	102.75 (10.20)	1.34	.81
≥5 displays	42	103.21 (8.56)		

\*  $p < .01$ , \*\* $p < .05$

# APPENDIX F - Figure E.1 Summary of Main Study Findings



Note: [Group means adjusted for SES at 2 years]; [Group means adjusted for child estimated Full Scale IQ at 4 years]; NS denotes no significant group difference at  $p<.05$ .